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ELECTIVE INDUCTION OF LABOR AT GRACE-NEW HAVEN COMMUNITY HOSPITAL: A TWO YEAR STUDY

GARY LAWRENCE GROSS

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Elective Induction of Labor at Grace-New Haven Community Hospital: a Two Year Study

Gary Lawrence Gross,
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Dedication

Only Yale Medical students and their wives will understand how much this thesis owes to the patience and presence of Betsy Shure Gross. I dedicate this to her.

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No formal acknowledgement can fully express my gratitude to Dr. C. D. Davis for his interest, his assistance, and his unfailing support which were an unmeasurable aid in the completion of this thesis. I would like to acknowledge my debt also to Mrs. Carol Hopkins of the Yale Computer Center for her cooperation and assistance in the programming of the data for this project.

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INTRODUCTION

The past two decades have witnessed a great increase in the popularity of elective induction of labor. It has been estimated[1,42,53,72] that as many as one third of current pregnancies are or could be terminated by electively induced labor. The modern frequent need of making long trips to the hospital once labor has begun, the increase in demands upon the physician's time, and the development of more efficient and allegedly safe techniques for accomplishing induction are among the factors which have prompted this increase in popularity.

The advantages and indications for elective induction at term have been listed by many authors[3,4,5,14,15,26,33,34,65,67,72,73] These include: decrease in the length of labor, prophylaxis of precipitate, unattended labor and delivery in women who live a considerable distance from the hospital or whose transportation is uncertain, decreased risk of aspiration during anesthesia, improved psychological attitude of the expectant mother which enables her to cooperate more effectively with her physician during labor and delivery, constant attendance and supervision of labor by the obstetrician, more attention from the nursing staff and other hospital personnel, and the opportunity for both expectant mother and physician to arrange their affairs at home and office. Against these advantages are ranged the hazards of induction. These may be divided into the hazards associated with

surgical and the dangers attendant on medical induction of labor. The hazards of surgical induction include injury to the presenting part, displacement of the presenting part with resultant malposition, prolapse of the umbilical cord, and a prolonged latent period between induction and the onset of labor with its danger of superimposed infection of both mother and unborn child. The hazards associated with medical induction include uterine spasm with resultant obstruction to the placental circulation, premature separation of the placenta, uterine rupture, cervical and vaginal lacerations, and postpartum hemorrhage. Associated primarily with both methods, but perhaps somewhat more closely with amniotomy, is the danger of delivery of a premature infant and consequent increase in perinatal morbidity and mortality. Associated with both methods, but more closely with the use of oxytocics, is the danger of a tumultous labor with increased risk of fetal anoxia and fetal and maternal trauma. All writers on the topic agree that contraindications to elective induction include absolute cepholopelvic disproportion, a fetus weighing less than an estimated 2500 grams, lack of trained staff and facilities for dealing with possible complications, and unwillingness of the patient. The latter is quite important, for the doctor is liable legally for all complications of elective induction.[38] Some authors are opposed to elective induction

of grandmultiparas or women whose uteri have been weakened by previous operative procedures,[28] and some are opposed to elective induction of nulliparas[3]. Some disapprove of elective induction of women with breech or abnormal presentations or those with multiple pregnancies[55], others do not. Preference for surgical and medical methods varies with the obstetrician's opinion of the hazards and efficacy of the different techniques. Almost all authors agree that selection of patients for elective induction must depend on the absence of contraindications, pregnancy at or near term by history and physical examination, and suitable findings at pelvic examination. However, many disagree on what constitutes a relative contraindication and many argue about what constitutes suitable vaginal findings. A substantial number of authors propose that all women who fulfill their particular criteria and are desirous of having pregnancy concluded should be electively induced. Others deplore the use of a procedure which interferes with the natural course of events merely because it has been proven safe[25]. More vociferous opponents of elective induction, skeptical of its safety, do not believe the benefits obtained warrant the risks entailed[75].

The early literature on elective induction deals principally with the efficacy and hazards of amniotomy. Few of the early papers clearly distinguish elective and indicated induction. Other early papers deal with the

same aspects of the use of posterior pituitary extract. The introduction of the intravenous technique of administering oxytocin prompted numerous reports on the safety, efficacy and hazards of this technique and not a few which advocated the superiority of oxytocin over amniotomy for elective induction. Subsequent articles have emphasized the importance of careful selection of patients, contending that proper selection, coupled with careful management, reduces the potential hazards of elective induction to a minimum.

Surgical induction of labor, using amniotomy, was practiced by the British in the mid-eighteenth century[35]. However, prior to the 1930's the practice of surgical induction was limited to the use of bougies and animal bladders with an attendant high morbidity and mortality. Rediscovery of amniotomy's effectiveness in the early 1930's gave impetus to the then quite limited practice of elective induction[31,51,56,67,69].

Slemon[67], former Professor at Yale, was one of the first to add artifical rupture of the membranes to the prevalent custom of using combinations of castor oil, quinine, and intranasal Pituitrin for induction of labor. He induced labor electively, accepting a history of short labors in a woman who lived a considerable distance from the hospital as a valid non-obstetrical or medical indication for induction. Guttmacher and Douglas[36], prompted by Slemon's

report, reviewed 120 cases of induction at Johns Hopkins in 1931 using similar methods. Interestingly enough, they concluded quinine and castor oil were of value in shortening the latent period between amniotomy and labor, but that Pituitrin was of little value. They reported that amniotomy was preferable to bag and bougie and that it served to decrease the length of labor and the incidence of puerperal infection, but had little effect on perinatal mortality. Most of their cases would be considered elective today. Stern[69], working at Johns Hopkins two years later with similar methods obtained similarly good results. He was so impressed with the efficacy of induction that he advocated routine induction at term.

Plass and Seibert[56], reported in 1936 the first of a long series of papers dealing with the elective induction of labor at University of Iowa Hospital. This hospital, because of its practice of bringing gravidas from outlying areas to the hospital two weeks before term, was a logical place for the practice of induction of labor for convenience[48]. In this first series from Iowa, castor oil, quinine, and some cases Pituitrin were used in combination with amniotomy. Five prolapses of the umbilical cord, and twenty-one perinatal deaths occurred in 681 labors, 597 of which had been induced electively. Of the twenty-one deaths, two were secondary to prolapsed cord and nine were neonatal deaths in premature infants.

Plass and Seibert concluded that induction ought to be performed only when indicated.

Their unsatisfactory results have been attributed to the unsatisfactory status of their patients' cervices[14]. In only forty-eight of their 681 patients was the presenting part engaged or the cervix at all effaced. Moreover, in thirty two cases digital or instrumental dilatation of the cervix was required before amniotomy could be performed[56]. It is doubtful that modern writers on the subject of elective induction would have induced many of Plass and Seibert's patients. However, it is not quite so certain that these patients might not be induced by many who practice elective induction but do not write about it. Hall[37] has demonstrated the wide range of variability in the criteria for a "ripe" cervix among trained obstetricians. These criteria are surely more variable among general practictioners who perform elective inductions. One cannot be quite certain that the patients whom these men induce are not comparable to Plass and Seibert's, and are not liable to the same complications which they incurred twenty nine years ago. It is this possibility which has led many conservative obstetricians to oppose induction of labor electively[48,75] and has led its proponents to advise that elective inductions be performed only by well trained obstetricians in large, well attended university hospitals[3,22,26,49].

One of the few advocates of more widespread use is Stubblefield[72]. It is his contention that the complications which might arise as a result of the induction of labor are no different from the complications of spontaneous labor. Any hospital which has been adjudged competent to handle the latter should be capable of handling the former as well[72].

Reports on the use of amniotomy for elective induction remained conservative throughout the late 1930's and the 1940's. Roblee[63], reviewing the use of amniotomy for induction over a period of 16 years, exemplified opinion of this period. He noticed little or no morbidity in labors induced electively 24-48 hours before they would have occurred spontaneously, but declared that such inductions had "little or no obstetric advantage". Keettel, Diddle and Plass[46], reporting on an enlarged series of 1000 inductions at Iowa, noted that the incidence of intrapartum infection and prolapse of the umbilical cord or of the arm was double that of a group of women with spontaneous premature rupture of the membranes. They concluded the risks of elective amniotomy counterbalanced the advantages of elective induction. Dieckmann and McCready[15], reported amniotomy to be an effective means of inducing labor. They approved of Slemon's inclusion of distance from the hospital and previous rapid labors among indications for

induction, but strongly disapproved of routine induction at term.

Grier[34] took a more favorable view of the use of amniotomy for the "precipitation of imminent labor". He demonstrated a reduction of both maternal morbidity and perinatal mortality in a series of 129 patients. He believed that this, coupled with the general advantages of elective induction previously stated, warranted the elective use of amniotomy when the spontaneous onset of labor could be considered imminent on the basis of vaginal examination.

In 1950 and 1951 Reycraft[61], Husbands[43] and Hanley[38] published similar favorable reports on the elective inductions of labor with amniotomy, placing considerable emphasis on careful selection of patients. Eastman, commenting on an abstract of Hanley's paper in Obstetrical and Gynecological Survey[22], was moved to note that though there was a "substantial body of opinion opposed to the elective induction of labor by amniotomy;...amniotomy (in the proper hands) is just about a 100% safe and efficient method of initiating labor...in a gravida at term, with the head at or below the spines, and the cervix soft, 50% or more effaced and one or two centimeters dilated... To ignore these criteria is one of the surest ways of walking into grave trouble..."

Willson[75] gave voice to the substantial body of opposition

in a paper published in 1952. Admitting that elective induction could be performed with relative safety by the qualified obstetrician, he argued that it still entailed substantial risks and was productive of few benefits. He based his argument on the results of 180 inductions, 130 of which had been indicated, and on the post hoc conclusion that only four of 64 perinatal deaths in a large series of spontaneous full terms labors might have been prevented by earlier induction.

In the early 1950's the practice of elective induction of labor was markedly altered by the introduction of the intravenous technique of administering oxytocin. Oxytocin and its predecessor, posterior pituitary extract, had enjoyed a rather chequered history in obstetrics. This history is worth tracing briefly, since many of the opinions formed about oxytocics during periods of earlier use still persist and color the arguments of both opponents and advocates of elective induction.

Introduced into clinical obstetrics by Blair-Bell and Hofbauer in 1909 and 1911[40], posterior pituitary extract attained widespread popularity as a means of inducing labor or stimulating lagging labors. Obstetricians of the years just prior to and during World War I used poorly standardized preparations of pituitary extract administered in subcutaneous or intramuscular doses of 15 minims[19,40]. Not

surprisingly, in the light of modern knowledge, reports of uterine rupture, tetanic contractions and fetal asphyxia associated with the use of posterior pituitary extract soon became current. By 1920 its use in the first two stages of labor had become a "heinous obstetrical sin"[21] in the minds of most conservative obstetricians. Sternly opposed by such leaders in the field as DeLee and Greenhill[40], its use remained an anathema to the great majority for two decades.

Despite its major abandonment pituitary extract or Pituitrin continued to be used sporadically in small doses of one to three minims for the induction of labor. Combining it with castor oil and small doses of quinine gained some popularity in the 1920's. Later on this was supplemented with amniotomy as has been noted. One variation of this routine was to administer Pituitrin intranasally [19,36,40,69]. It was thought that better control of absorption was obtained this way. This method never really replaced the more standard intramuscular route of administration. During the 1920's pituitary extract was standardized and then in 1928 Kamm prepared a vasopressin-free extract, Pitocin[19,40] which gradually replaced Pituitrin, the earlier vasopressin-contaminated preparation.

In the 1940's two papers, one by Reid[60] and the other by Eastman[21] on the use of pituitary extract in the treatment

of uterine inertia, did much to dispel the disapproval in which oxytocics had been held. Reid used doses of one to three minims and found none of the severe lacerations of the birth canal[60] that had been attributed to the larger doses of pituitary extract by J.B. DeLee[40]. Reid advocated starting with minimal doses and cautiously increasing the dosage until a satisfactory uterine response was obtained. Eastman[21] considered the hazards of pituitary extract slightly preferable to the consequences of uterine inertia, but declared that using pituitary extract to "push labor in patients who are not in labor at all...will only head to trouble..."

Page used dilute intravenous Pitocin to stimulate labor in cases of uterine inertia in 1943[19,50]. It was not until publications by Theobald[8,19], by Hellman, by Stone, and by Lubin in the late 1940's that this technique gained widespread attention[50]. It soon replaced intramuscular Pitocin as an adjunct to amniotomy in the induction of labor. However, its role here remained in dispute. Jacobs[44] advised using it in women whose labors had not begun three hours after amniotomy, while Willson[75] advocated its use only after twelve hours had elapsed following amniotomy. Douglas et al[19] believed that the combination of amniotomy and Pitocin was capable of producing an undesirably rapid and tumultous labor. They

believed that Pitocin was generally not necessary in women who had had their membranes ruptured artificially and that it was unwise to combine the two. Bishop[3,4], too, believed Pitocin unnecessary in those patients who had been selected properly for elective amniotomy, but did think its use shortened the latent period between rupture of the membranes and the onset of labor. Daichman and Pomerance disagree[13]. They thought Pitocin had no effect on either the length of latent period or labor, and that its use was associated with an increased incidence of postpartum hemorrhage. They advised against its use. Keettel[48] condemned routine use of Pitocin after amniotomy, particularly when an intravenous infusion was continued after labor had begun so that "normal labor is being accelerated... under the guise of induction". Some authors attempted to use intravenous Pitocin alone to accomplish induction. Reynolds and his coworkers[62], using tokodynamometry to measure the effects of intravenous oxytocin on uterine contraction, noted that amniotomy appeared to be essential for the induction of labor with oxytocin infusion. Stone et al[1,70,71], quite to the contrary, concluded that rupture of the membranes once labor had begun enhanced the effect of an oxytocin infusion, but was not essential for induction.

Despite opposition and questions about when it should be used, widespread use of intravenous oxytocin for

stimulation and induction of labor was attested to by Hellman's report of 1956[39]. By the time this report was published a standard technique for intravenous use had been developed. The customary dilution was ten units of oxytocin in one liter of 5% glucose and water[8]. A few authors employed even higher dilutions[59,73]. The infusion was started at the rate of 4-8 drops per minute. The rate of flow could be increased with safety to 40-60 drops per minute provided this increase was made gradually, using increments of 4-6 drops at intervals of 20-30 minutes. There have been few major deviations in this technique since that time. One such deviation is Douglas and Dillon's proposal that Pitocin be administered transbucally[19,20]. However, the rate of failure to induce labor with this technique is quite high[20] and it seems unlikely to become popular.

Use of intravenous oxytocin for elective induction had very definite advantages over amniotomy. It did not commit the obstetrician to delivery, for it did not impose the danger of a prolonged latent period with ruptured membranes and its attendant hazard of amnionitis. If the infusion failed to produce labor it could be discontinued. The patient could be rested and given another infusion or discharged to return at a later date. Some authors claim that oxytocin has the additional advantage of being

able to discriminate between a patient whose uterus is ready for labor and one whose uterus is not, thus in some measure reducing the incidence of premature births in electively induced labors[1,54]. This same virtue has been claimed for sparteine sulfate, a recently popular oxytocic drug.[57]

In 1958, Guttmacher[35] summarized the case for intravenous oxytocin as the primary method to be used in the elective induction of labor. He contrasted the results of a series of 1481 elective inductions using Pitocin, followed by rupture of the membranes <u>after</u> labor had begun with Keettel's series of 6860 inductions using amniotomy.[48] Guttmacher concluded that Pitocin was superior to amniotomy in regard to both maternal morbidity and fetal mortality, but inferior to it in regard to uterine rupture. There were three cases of the latter but two were very definitely associated with the application of midforceps.

Stone and Guttmacher's techniques of combining an intravenous infusion with late amniotomy, if the membranes were still intact, proved to be most efficient and contributed to an upsurge of interest in elective induction. This growing popularity discomforted both its opponents and its proponents. The former revived J. Whitridge Williams' comment on the introduction of prophylactic forceps, "I believe if this practice were to become general

and widely adopted women would be worse off eventually than had their labors been conducted by midwives",[*] and applied it to elective induction. While conceding elective induction's relative safety in the hands of experts, they inveighed against its use by non-experts or its being taught to medical students. The proponents of elective induction, mindful of the ill repute in which Pituitrin had been held after its early period of promiscuous use, issued pleas for the judicious and careful use of the intravenous infusion and other techniques of elective induction[49]. They emphasized repeatedly the importance of proper selection of patients. If the patients were properly selected and careful attention was given to the techniques of induction, they maintained that the potential hazards of elective induction did not materialize and elective induction properly performed, was, like elective forceps, another safe method of improving the conditions of labor and delivery. Therefore, many papers of the mid-1950's and since then have dealt with modifications of technique which were helpful in reducing the incidence of complications and with examination of the criteria for selection of patients in order to determine which patients were most

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[*] DeLee, J. B.: The prophylactic forceps operation. Am. J. Obst. & Gynec. 1:34, 1920

likely to benefit from the advantages of elective induction and least likely to have complicated labors.

Erving and Kenwick[23] reviewed 600 cases of elective induction, using a combination of amniotomy and intramuscular Pitocin. They induced 14.3% of their private patients. The criteria for selection of their patients were the absence of general contraindications and the presence of vaginal findings of a cervix dilated three centimeters and 50% effaced with the presenting part fixed or depressible into the true pelvis. Among their 600 patients were 108 primigravidas, forming 18% of the total. Eight of the primigravidas were among the fifteen patients in the series whose latent periods lasted over eight hours. One of every five primigravidas had labors which exceeded twelve hours. They concluded that there was little advantage to routine induction of primigravidas at term.

Daichman and Pomerance[13] used similar criteria in selecting 557 multiparous and 100 nulliparous patients for elective induction. The maternal complications they encountered were minimal. Their corrected perinatal mortality was only 0.3%. They noticed that both the latent period after induction and the succeeding labor tended to be shorter in women with more widely dilated cervices at the time induction was attempted.

Hukill[42] reviewed nearly 6000 cases of elective induction in a total obstetrical population of 23,091, though his data were often calculated on the basis of only portions of the total population. The vaginal criteria for induction which were employed in his series were a soft, 50% or more effaced, one to two centimeter dilated cervix, with the presenting part readily engageable on applying fundal pressure. Not opposed to inducing breech presentations, he advised against inducing nulliparas, for the advantage of prophylaxis against a recurrent rapid, unattended labor did not exist, while the hazard of frequent complications of labor did. Though only one sixth of his induced patients were nulliparas, they were involved in nearly 45% of the complications. Hukill also disapproved of the use of pituitary extract in grand multiparas, relating the incidence of uterine rupture (0.036% in induced versus 0.034% in the spontaneous labor group) to parity rather than the use of an oxytocic. Sicuranza[66] has disagreed with this, preferring the risk of using an oxytocic in a grand multipara to that of electively delivering per vaginam patients who had had previous ceasarean sections.

Ratzan and Shulman[59], using intravenous Pitocin to induce 250 patients, 184 of them electively, noted that among the elective inductions the onset of labor was delayed

two to three hours in ten patients with unfavorable cervices. They concluded that the station of the presenting part was of minor importance so long as it was engaged. They were not opposed to inducing multiparas with the fetal presenting part at minus one or minus two station, but noticed that the higher the station, the longer the latent period tended to be. Evans[25] noted that the position of the head at surgical induction of labor was the most important factor in influencing the incidence of complications. When the head was not engaged at induction there was a higher incidence of prolonged latent periods and prolapsed cords with resulting increase in the incidence of maternal morbidity and fetal loss.

Stone, Gordon, and Folsome[71] utilized cervical criteria similar to Hukill's in selecting 672 patients to undergo induction with intravenous oxytocin, 433 of them electively. The data from their series, which included 550 cases of oxytocin stimulation as well, is somewhat difficult to interpret since they do not always define whether the complications they encountered were the result of stimulation or induction. However, they noted no maternal mortality, ruptured uterus or maternal morbidity "attributable to the use of oxytocin". They induced breeches as well as vertices, having noted earlier[70] that breech presentation was no contraindication to the use of an intravenous

oxytocin drip.

Tafeen[73] reported 510 elective inductions performed on patients para i-iv who were at or near term by date and estimated fetal size and on vaginal exam had soft, yielding, effaced cervices, two to three centimeters dilated, with the vertex presenting below the inlet and easily brought to the ischial spines with suprapubic pressure. He used Pitocin intravenously. He selected a control group of 2000 consecutive patients of similar parity whose labors began spontaneously. Patients with placenta previa, toxemia, abnormal presentations or infants under 2000 grams at birth (57 of these) were excluded from the controls. He reported no prolapsed cords, uterine ruptures, tetanic uterine contractions, cervical dystocia, placental abruptions, or uterine inertia in the induced group. Of these, 85.3% delivered in less than 5 hours, the comparable figure for the controls being 47.0%. The incidence of cervical laceration and puerperal morbidity was reduced, while the incidence of postpartum hemorrhage in excess of 500 ml. was nearly equal. There was no marked difference in the incidence of neonatal depression, but there were fewer cases of fetal bradycardia or meconium passage during labor among the induced. The incidence of neonatal atelectasis was doubled, 0.8% among the induced versus 0.43% in the control group. There were two neonatal deaths in the

induced group. One of the two neonates who died was the child of a woman whose membranes had been ruptured forty-eight hours before induction and whose induction should be considered indicated. The incidence of premature births was 5%, about the same as for the control group. None of the prematures weighed less than 2000 grams. Twelve of the twenty-five of them had been thought to weigh over 2500 grams at induction.

Sotto and Wildhack[68] reported on 500 elective inductions, including 100 primigravidas, and compared the outcome in those who had favorable and unfavorable cervices. The authors were not responsible for the induction of all patients, but did examine all of them before induction was performed. They noted a much higher incidence of prolonged latent periods, prolonged labors, and of every other complication encountered among the patients with unfavorable cervices. Though the unfavorable group comprised only 24% of the primigravidas and 13.75% of the multigravidas, in many instances they comprised the bulk of the cases with complications. The primigravidas also achieved more than proportional representation in the cases with complications.

Nichols[53] evaluated 360 unwed mothers, 83 per cent of them nulliparous, for possible elective induction with amniotomy, using the vaginal findings of a vertex presentation at minus one station with a cervix one to two centimeters

dilated, soft, and anterior, and estimated fetal size of 2500 grams or more as his criteria for eligibility. He found 172 patients to be induceable, but only induced 115 of them as the others began labor spontaneously before induction could be attempted. The per cent of induceable and actually induced nulliparas was approximately 83, almost identical with the incidence of nulliparas in the whole population of 360. There were no cesarean sections among the induced group and only one perinatal death, this being attributable to congenital anomalies. The length of labor, the incidence of maternal complications and the incidence of prematurity were reduced among the induced. Nichols was convinced that nulliparas as well as multiparas could be safely induced electively.

Schaeffer[65] presented a series of 277 inductions with intravenous oxytocin done in the course of 1000 consecutive term deliveries. With few exceptions, all the inductions were performed electively. He concluded that the hazards of elective induction were more potential than real and could be minimized by careful selection and intelligent management. He incurred no failed inductions, no maternal deaths, no uterine ruptures, no cases of amnioitis, no excessive postpartum bleeding, no prolonged labors or latent periods. There were no fetal deaths. There was one cesarean section performed because of persistent fetal

bradycardia. The incidence of midforceps deliveries was reduced when compared with 498 spontaneous labors. Three babies were delivered as breeches. Seven infants or three per cent of the deliveries were born weighing between 2270 and 2724 grams, four of them being twins. There were three sets of twins, all diagnosed prior to induction. The one complication was that 66% of the labors were precipitate, nearly 27% occuring in less than one hour. However, all but eleven of his patients were multiparas, para i to para iv. Though 93.5% or all but eighteen of the induced patients delivered in less than four hours, eight of the eleven nulliparas induced delivered after labors between four and eight hours long. He decided there was little advantage in the induction of nulliparas. The criteria he used to select his patients were parity, an estimated fetal size of between six and eight and one half pounds, a gestation within ten days of term by dates, no adverse obstetrical history, willingness for induction, and on vaginal examination an ample pelvis, vertex presentation at station minus one or lower, and a cervix not posterior and not less than 60% effaced and three centimeters dilated. He observed that it was seldom possible to determine optimal changes in the cervix more than twenty-four to seventy-two hours in advance of the onset of spontaneous labor. Often a patient whom he had decided to induce the following day

went into labor that evening.

Fields and his coworkers have presented a series of articles[26,27,28,29,30] in which they have reviewed the results of elective induction of labor at the hospital of the University of Pennsylvania School of Medicine. They establish their criteria for selection of patients and discuss at length the technique of inducing with an intravenous Pitocin followed by amniotomy once labor is established. Their total series of 3324 patients[27] spans a nine year period. The length of their study gave them the opportunity to evaluate more recent technical refinements and their effect on complications. They noted reduction of the incidence of uterine spasm from 8.4% in nulliparas to 2.8% and from 4.3% in multiparas to 1.6% with reduction of the amount of Pitocin used. Similarly, continuing the Pitocin infusion two to four hours beyond delivery resulted in a reduction of the incidence of significant postpartum hemorrhage from 3.0% in the 1950-1952 portion of their series to 0.6% in the 1956-1958 portion. On the other hand they noted an increased incidence of premature placental separation in the later years of their series. Two of the thirty cases in which this complication occurred required cesarean section and three required emergency vaginal delivery. All the infants involved survived and

did well. Fields and his coworkers attributed the increased incidence of premature separation to an increase in the use of caudal anesthesia, noting a parallel rise in incidence of premature separation with increased use of caudals in their general obstetric population. The incidence of signs of fetal distress in their series rose from 2.0% in the early years to 4.2% in the later years. They believed this to be related to the greater attentiveness of observers rather than a true increase in frequency. It has been pointed out by other authors[1] that the combined incidence of evanescent and steady fetal bradycardia, tachycardia, and irregularity of the cardiac rate has been about 5% in electively induced labors and 8% in spontaneous labors. None of Field's patients who exhibited signs of fetal distress during labor were delivered of infants in serious condition, including two cases in which delivery was effected by cesarean section.

The criteria Fields employed in selecting patients for elective induction were stated in his initial series[26]. These were that the patient be at thirty seven weeks or more of gestation by history and fetal size, that on vaginal exam the presenting part be dipping well into the pelvis and preferably be engaged, and that the cervix be 50% or more effaced and at least one centimeter dilated.

In 1959 Fields reviewed the results of his first reported 2932 elective inductions[29], among them 714 inductions of nulliparas, concluding that there was "no appreciably greater risk in the elective induction of the nullipara than of the multipara." His criteria for selection of nulliparas were stricter than those for multiparas. He required that the nulliparous cervix be 80% or more effaced and at least two centimeters dilated.

E. H. Bishop, quite to the contrary, has presented a series of articles in which he has urged most emphatically that induction be limited to the multipara[3,4,49]. In 1955, Bishop[4] presented a series of 1000 elective inductions at Pennsylvania Hospital. All but thirty-seven of them were performed on the private services, and accounted for 21.6% of the total number of deliveries. Five obstetricians performed 52% of these 963 inductions. There were 165 nulliparas included in the series with an average length of labor of 7.4 hours. Forty per cent of the nulliparas had labors lasting more than eight hours, and only 22% had labors less than four hours long. The corresponding figures for multiparas were 93% and 56%. Moreover, Bishop found that pelvic findings in nulliparas prior to induction could not be utilized to predict the length of labor as they could be in multiparas. Thirty-eight per cent

of nulliparas who had cervices 70% or more effaced and three centimeters dilated, with vertex presentations at station 0, presumably ideal findings, had labors lasting more than eight hours. Bishop concluded that there was little advantage in inducing nulliparas electively.

In the same paper[4], Bishop demonstrated that 343 multiparas whose cervices were 60% effaced, three or more centimeters dilated and in whom the presenting part was at station minus one or lower all delivered in less than four hours. The average duration of labor for these women was 3.2 hours, 32% shorter than the labors of multiparas with less favorable cervices. He argued that the best results in elective induction could be obtained by choosing patients who fit the criteria these 343 women had met. Liberalization of these criteria led to poorer results. In Bishop's 1955 series, the average length of labor and the percentage of patients with labors over eight hours long increased with the increase in frequency with which five private obstetricians performed elective inductions. In a slightly enlarged series, presented in conjunction with R, A. Kimbrough, Bishop demonstrated that the incidence of midforceps deliveries, though still only 2.4%, was more than twice as high in those with pelvic findings not conforming to his standards as it was in those who did conform. Similarly the incidence of prematurity was three

times as high. When fetal deaths attributable to congenital anomalies or erytroblastotic were excluded, there were no perinatal deaths in the so-called favorable group, but one stillbirth and one neonatal death occurred in those with unfavorable pelvic findings[49].

In Dr. Bishop's personal series, wherein he reports induction of approximately 20% of his own private patients[3,5], he notes no appreciable increase in maternal and fetal complications with elective induction. Reporting on 325 elective inductions using amniotomy with occasional oxytocin supplementation, he noted no prolapsed cords, one premature infant weighing 2381 grams and only one perinatal death. The latter occurred in an erythoblastotie infant[5]. He concluded that the patients who will profit from elective induction of labor constitute a select group, limited to approximately 20% of the obstetric population.

Bishop is another author who holds the view that one can rarely determine optimal pelvic findings more than seventy-two hours in advance of the onset of spontaneous labor[49]. Recently he published a paper[6] in which he correlated pelvic findings in 500 pregnant women with the time lapse between the last vaginal examination and the spontaneous onset of labor. Based on this study Bishop presented a pelvic scorecard as a guide for determining readiness of the patient for elective induction. Patients

are graded on the basis of cervical dilatation, effacement, consistency and position, as well as the station of the vertex. A score of nine in a multipara past thirty-seven weeks and without any contraindication to elective induction prognosticates a safe and successful induction.

In contrast to Bishop' and Field's endorsements of elective induction are several recent papers by Keettel[48] and by Niswander[54,55] and their coworkers. In 1958 Keettel presented a review of the 6860 elective induction performed at Iowa University over a 30 year period beginning in 1926, amniotomy being the principal technique employed. He concluded that even the expert obstetrician should maintain a conservative attitude toward elective induction while the general practitioner should be enjoined from employing it. The criteria established for selection of patients for induction were: single pregnancy, pregnancy at term by date and fetal size, fixed vertex presentation, and partial cervical effacement and two centimeters dilatation. The patients for induction were chosen by first year residents. Keettel's data, which includes Plass and Seibert's original series[56], attests to both divergence from the basic criteria and failure to accurately determine them in not a few instances. Consequently, there were twenty-nine unrecognized multiple pregnancies, thirty-five

unrecognized breeches, eighteen compound presentations, and nine transverse lies which developed at or subsequent to amniotomy. The principal hazards to induction were fetal in Keettel's opinion. Foremost among these were: (1) prematurity which occurred with a frequency of 3.1% nearly 10% of the 212 prematures weighing less than 2000 grams, (2) abnormal presentation, which, including breeches, occurred in 0.9% of deliveries, (3) prolonged latent period following amniotomy with the danger of infection, and (4) prolapsed cord which occurred in 0.3% of the inductions. The perinatal loss in cases of transverse lie or prolapsed cord was approximately 50%, the loss in breech or compound presentations was approximately 15%, while 10% of the prematures succumbed as a result of respiratory difficulties or intracranial hemorrhage. Total perinatal loss was ninety-two of 6889 infants or 1.34%. Thirty-nine of these deaths were considered directly related to induction, producing an associated perinatal mortality of 0.6%. Moreover, Keettel does not include among the directly related deaths those infants dying of unknown causes, those who died as a result of respiratory distress not associated with prematurity, and those who died as a result of sepsis associated with delayed onset of labor.

Niswander, in two papers published in 1960[54] and 1963[55]

uses both his own and Keettel's data[48] to demonstrate increased danger for the newborn when amniotomy is utilized as part of the means of electively inducing labor. In the second paper he compares the results of his series, in which no unusual circumspection was taken by the doctors involved in selecting patients, with Keettel's series in which Niswander presumed such circumspection to have been taken. He employs this comparison to demonstrate the futility of attempting to set criteria for selection of patients when the selector is liable to human error. Niswander, like Keettel before him, concludes that the principal hazards of elective induction are fetal. The perinatal mortality in Niswander's series is 1.2%,and twenty of the thirty-two deaths are attributed to induction, resulting in a related perinatal mortality of 0.7%. The deaths which Niswander attributes to induction include fifteen deaths as a result of prematurity and/or hyaline membrane disease, one intrapartum and one neonatal death associated with prolapsed cord, and three neonatal deaths as a result of severe intracranial hemorrhage. He notes an incidence of prolapsed cord of 0.38%, double Hukill's[42] incidence of 0.195% in spontaneous labors. Niswander[55] concludes, "The frequent election of induction......will account for some increase in the perinatal mortality rate....(and) requiring rigid criteria to be met before elective induction is permitted

will not significantly lower the risk of infant mortality".

Review of the literature attests to both increasing acceptance of elective induction of labor and persistent doubt of its wisdom and safety. It was decided, therefore, to review the results of elective inductions of labor at Grace-New Haven Community Hospital.

There were 813 patients on the general service and 341 patients on the university service coded[*] as having undergone induction of labor during the period January 1, 1961 ---December 31, 1962. The records of all these patients were reviewed and their intrapartum and postpartum histories were evaluated. The prenatal history was evaluated as well in all university and ganeral service patients where this was available. The university service includes all ward patients and the private patients of the full-time obstetrical faculty. The general service includes the private patients of all local physicians with obstetrical privileges at Grace-New Haven Community Hospital. For the most part these physicians are board certified obstetricians. There are a few general practitioners. They are not allowed to induce labor within the hospital confines without prior consultation.

The histories obtained were evaluated to determine whether induction or stimulation of labor had been performed. Stimulation was defined as the discrete use of oxytocin, sparteine sulfate, amniotomy, or digital stripping of the membranes once labor had begun. Amniotomy was not

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[*] Obstetrical Statistical Cooperative

considered stimulatory if performed after seven centimeters dilatation was attained. Oxytocin infusions were considered discrete if more than one hour separated the termination of the first and the start of the second. A course of sparteine sulfate was considered discrete if more than four hours had elapsed between the last injection of one course and the first of another. If oxytocin administration or a course of sparteine were not discrete, but continuous with an induction procedure they were not considered to have been used for stimulation. The same definition of discreteness was applied to inductions with oxytocin or sparteine in distinguishing between single and multiple try inductions.

True labor was considered to have begun when progress in cervical dilatation was noted[76] or when previously observed contractions became regular and progressively more intense, occurred at gradually decreasing intervals, and, during or shortly after the establishment of such regularity, effected cervical dilatation[76]. Contractions less frequent than once every five minutes were never considered regular. Contractions which became regular under the influence of oxytocin or sparteine, but irregular once these oxytocics were discontinued were not considered part of true labor unless progress in cervical

dilatation had been made. Contractions which, having become regular and effected cervical progress, became irregular on administration of morphine sulfate were considered part of true labor provided they were resumed within twenty-four hours of the last dose of morphine. Oxytocics administered or amniotomy performed during such a "morphine rest" were considered stimulatory rather than inductive.

It was determined next whether induction was indicated or elective. Indications for induction included placenta praevia or question thereof, abruptio placenta, eclampsia, preeclampsia, habitual intrauterine death, polyhydramnios, a history or evidence of current Rh or ABO sensitization, maternal diabetes, vulvar vaucosities or severe vaucosities of the lower extremities with recurrent thrombophlebitis, decompensating cardiac or renal disease, maternal fever of more than 101°F after thirty-six weeks of gestation, post-maturity, premature rupture of the membranes of over twenty-four hours duration, cephalopelvic disproportion, and a fetus which, based on past history of overly large babies and estimated length of the present gestation, was considered likely to be excessively large at full term. In addition, premature rupture of the membranes of more than twelve hours duration was considered to force the obstetrician's hand sufficiently to make induction warranted. Ruptured

membranes of less than twelve hours duration were not considered an indication for induction.

Postmaturity was defined as gestation lasting more than forty-two weeks. A rise in blood pressure of 30 mm. Hg above normal systolic levels or of 15 mm. Hg above normal diastolic levels, or the development of a systolic pressure of 140 mm.Hg or a diastolic pressure of 90 mm. Hg; the development of significant proteinuria in the absence of demonstrated infection; and persistent edema of the hands or face were considered individually or in combination to be evidence of preeclampsia.[76]

One woman was included in this series whose membranes were thought to have ruptured at the time of her first two inductive attempts. After the second attempt had been performed, it was discovered that her membranes were intact and an attempt was made to induce her electively. Another woman was included who, after several failed elective induction attempts, became toxemic and underwent several indicated induction attempts. Several other women whose initial attempts at induction were elective but whose inductions subsequently became indicated because of postmaturity, temperature elevation or length of time since rupture of the membranes, were also included in the present series. Gravidas admitted contracting irregularly but not in true labor who were induced at this time were

considered to have been electively induced.

An induction was defined as a single try induction when only one effort had been made to induce labor. Such an effort could consist of one inductive measure or a combination of two or more different measures instituted within one hour of each other.[7] An induction was considered a double or multiple try induction when two or more discrete or different measures were employed with an interval of more than one hour between the institution of each. The latent period between induction and the onset of labor was defined as the time between the start of a simple single try induction and labor, the time between the start of the first part of a combined induction and labor, or the time elapsed between the last part of a multiple try induction and labor. A particular inductive effort was considered a failure if labor did not ensue within twenty-four fours. It was classified as possibly contributory or not fully assessableif labor ensued within twenty-four hours but another effort had been made in the interim. It was similarly classified if a cesarean section was performed prior to the start of labor and before twenty-four hours had elapsed. Induction was considered successful if labor ensued within twenty-four hours without any intervening inductive efforts.

Fetal distress was defined as passage of meconium

except in breech presentation, fetal tachycardia of more than 160 beats per minute, fetal bradycardia of less than 80 beats during contractions or less than 100 beats between contractions or any combination of these. Neonatal depression was defined as depression of the Apgar score below seven at one or five minutes. A premature infant was defined as an infant weighing less than 2500 grams at birth.

Standard puerperal morbidity was defined as a temperature elevation of 100.4°F. on any two of the first ten days of the puerperium, excluding the first twenty-four hours.[76]. One day temperature elevations of over 100.4°F. excluding the first twenty-four hours were also noted in this series. The cause of puerperal morbidity, when established, was done so on the basis of clinical findings as in thrombophlebitis or severe breast engorgement, or by culture. Positive cultures followed by prompt antibiotic therapy without the patient becoming febrile were also noted in this paper.

Postpartum hemorrhages were recorded when estimated blood loss exceeded 500 ml. or when shock associated with blood loss developed postpartum. Delayed hemorrhages attributed to retained secundines were not considered.

Labor was defined as precipitate if delivery was accomplished within three hours of the start of true labor. A first stage of three hours or less was often

synonymous with precipitate labor, though in not a few instances it was not. First stages of between three and six hours, six and nine hours, etc., were almost always synonymous with labors completed within the same interval.

Only lacerations requiring suture were recorded. A third degree perineal tear was defined as a laceration of the perineum involving the rectal sphincter.

All cesarean sections were low flap type. All patients examined vaginally or undergoing digital stripping of the membranes or amniotomy were handled with aseptic techniques.

Pitocin[*], Syntocinon[≠] and oxytocin were considered equivalent[16,18] and are called oxytocin in the body of this paper. Oxytocin was administered intravenously in almost all instances. The technique of oxytocin administration at this hospital has been described in a paper by C.L. Buxton and R. Hausknecht[8]. Briefly, ten units of oxytocin are diluted in a liter of 5% dextrose and water and administered via a two bottle technique. The rate of administration is initially eight drops per minute, but this increased at fifteen to twenty minute intervals by increments of four to eight drops until satisfactory contractions are obtained. Thereafter, the

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[*] Parke,Davis & Co., Detroit, Michigan

[≠] Sandoz Pharmaceuticals, Hanover, New Jersey

rate of oxytocin administration is slowed, but it is generally continued through delivery and into the postpartum period for a variable amount of time. On the general service the technique is essentially the same, but postpartum continuation of the intravenous oxytocin is less frequent. Methyl ergonovine tartrate is commonly given intramuscularly in its stead. On the university service a medical student or member of the house staff is in constant attendance on all patients receiving intravenous oxytocin. The attending physician or a medical student maintains an equally close watch on the patients on the general service. The fetal heart tones are ausculated every fifteen minutes throughout the induction and more frequently at its start.

Sparteine sulfate was administered in doses of 150 mg. in all but one patient in this series. She received an initial dose of 75 mg.

The data in this series was obtained directly from the records of the 709 gravidas deemed elegible for inclusion, was coded and placed on IBM punch cards. Many, but far from all, of the associations made in this paper were made with the aid of computers at the Yale Computer Center.

METHODS OF ELECTIVE INDUCTION---GENERAL SERVICE

On the general service 536 women underwent elective induction of labor. Six hundred twenty-three different attempts were made to induce these women. Stripping of the membranes to achieve induction was done thirty-two times. This figure includes one woman whose membranes had been stripped four times in her obstetrician's office without success. In one hundred seventy gravidas the membranes were ruptured artificially in order to induce labor. In another sixty-five amniotomy was combined as a single measure with an oxytocin infusion. Thirteen women received a combination of sparteine and amniotomy. Two hundred sixty-five attempts to achieve induction were made with intravenous oxytocin. Seventy-seven attempts were made with sparteine sulfate.

Stripping of the Membranes

Stripping of the membranes was the first inductive effort applied to twenty-five of the 536 general service patients (4.7%). In fifteen (2.8%) it was the only technique used. Fourteen patients were induced successfully with stripping of the membranes (2.6%). Six of the women

for whom stripping was the first mode of induction used had latent periods of less than two hours, nine (36.0%) had latent periods of less than four hours, and the remaining five who responded did so within ten to twenty-four hours. All but one of the fourteen successful inductions were fully dilated nine hours after labor had commenced. Four (28.6%) had first stages of labor lasting three hours or less, and six more had achieved full dilatation within three to six hours. The gravida who failed to go into labor had a spontaneous labor of between nine and twelve hours. One gravida was successfully induced with a combination of stripping and oxytocin as a first measure. In a second parturient this combination resulted in labor, but only after amniotomy and oxytocin had also been used.

Six women had their membranes stripped as the first portion of a double try induction. All but one went into labor within twenty-four hours of the stripping. The stripping was not considered to have failed in these women but their labors and complications were considered to be more directly related to the second measure used. Four more patients, including the woman (#0080) in whom four strippings were performed, had their membranes stripped as the first of three or more tries at inducing labor. All of these were considered failures because

labor did not ensue within twenty four hours. Three other gravidas had their membranes stripped as the second part of a multiple try induction. One of these patients went into labor between fourteen and eighteen hours later. Two women went into labor only after their membranes were ruptured. One of the latter strippings was classified a failure. One patient had her membranes stripped as the third part of a triple try induction. It failed and she subsequently went into labor spontaneously.

Thus in thirty-two instances in which stripping of the membranes had been used on the general service for induction, eleven were failures, and in only fifteen cases could labor be directly attributed to the stripping. The labors so induced were generally completed within nine hours.

Amniotomy

Amniotomy alone was used in 154 of the 536 women (28.7%) on the general service. In 144 (26.9%) it was successful without further intervention. Ninety-five of these 154 gravidas (61.7%) were in labor within an hour of amniotomy, 126 of 82.5% within two hours, and 135 or 88.4% within four hours. All but three of the 144 in whom there was no further intervention began labor within eight hours. These last three patients responded to amniotomy

after intervals of ten to fourteen hours. One hundred nine (75.7%) of the 144 women who had been induced with amniotomy alone were fully dilated within three hours of the start of labor, sixty-nine (47.9%) of them within two hours. One hundred thirty-four (93.1%) had first stages of six hours or less and all but two (1.4%) achieved full dilation within nine hours. In one parturient, #0578, meconium was noticed at amniotomy and the fetal heart rate fell to eighty. Because of this and because the labor which ensued almost immediately after amniotomy was considered "dyskinetic" she was stimulated with an oxytocin infusion. This was begun two hours after contractions had been established. The fetal heart rate again fell to eighty and remained irregular. Consequently after five and a half hours of labor she was sectioned. The infant was born with five loops of cord wound tightly around its neck. Its Apgar score was between four and six at one minute, better than seven at five. The child did well. Ninety-three of 143 labors completed after amniotomy alone (65.0%) were precipitate.

Nine parturients underwent amniotomy first and at intervals of between one and six hours were given oxytocin intravenously to achieve induction. One whose membranes had been ruptured first received subsequent sparteine to

induce labor. All began to contract effectively within two hours of the start of the second measure and all were delivered in six hours.

There were twelve women in whom amniotomy was used as the second part of a multiple try induction. Ten went into labor within two hours. Two received sparteine between one and two hours after amniotomy and were in labor within an hour of this. Eight of these twelve women had first stages of less than three hours as well as precipitate labor. All but one were delivered within nine hours and the last was in labor between nine and twelve hours. These women had all previously received sparteine or oxytocin, with the exception of two whose membranes had been stripped. Three women had amniotomy as the third part of a multiple try induction. All were in labor at two hours. Two had precipitous labor. The third was delivered in six hours. The patient previously noted, #0080, in whom four strippings had failed, subsequently became toxemic. Three oxytocin infusions and finally amniotomy were used to induce her. A labor of eight and one half hours began almost immediately after amniotomy.

Fifty-nine patients (11.0%) were considered to have had combined amniotomy and oxytocin inductions since the two measures were instituted within one hour of each other. All were in labor within three hours. Fifty (84.7%) began

to contract effectively within the hour. Forty-six of these women (78.0%) were fully dilated at three hours; all were fully dilated at six hours. Thirty-nine had precipitous labors (66.0%). Five more gravidas had a combination of amniotomy and oxytocin as the second measure of a double try induction and all were induced within two hours of the initiation of their second measure. All five delivered after less than three hours of labor. Thirteen patients had a combined induction with amniotomy and intramuscular sparteine. Twelve were in labor within two hours; one failed to go into labor and was subsequently induced with an oxytocic infusion. Of 247 women in whom amniotomy had been performed for induction this was the only failure. All twelve of the successful inductions were delivered within six hours; seven of them had precipitous labors.

Amniotomy was a singularly effective method of inducing labor. Used initially in 154 women it produced labor in 126 within two hours. Used second or later in the course of multiple try inductions in sixteen instances, it produced labor in twelve of these patients within two hours. Labor was attributable directly to amniotomy in 157 of the 170 women in whom it was used as a discrete measure. The labors amniotomy induced were generally short. One hundred three of 157 completed labors were precipitate

(65.6%). When used in combination with an oxytocin infusion, as amniotomy was in sixty-four women, the latent period between induction and labor was shortened. Forty-four of these sixty four labors were precipitate and all the patients were fully dilated in six hours. When combined with sparteine amniotomy was equally effective. However, one woman who received this combination had a failed induction. There was one cesarean section associated with the successful use of amniotomy.

Oxytocin

Oxytocin was used by itself as a first measure 215 times (40.1%). In 171 (79.5%) it produced labor on its own within twenty four hours. Of these, 134 (62.3%) were in labor at one hour; 153 (71.2%) were in labor in two hours; and 164 (76.3%) in four hours. The remaining seven successfully induced patients had latent periods of between four and fourteen hours. Four of these seven had latent periods of under six hours. Sixteen women who received oxytocin alone first (7.4%) were successfully induced within twenty-four hours of the start of the oxytocin infusion by a subsequent measure. Twenty-eight (13.0%) inductions with oxytocin failed. Eleven of these gravidas had subsequent attempts at elective induction,

six of which succeeded. Sixteen went into labor two weeks after the induction failed. She presented at that time with a transverse lie and spontaneous prematurely ruptured membranes.

One woman, para i, #1294, whose labor was induced with an oxytocic infusion of eight hours duration, went into labor promptly. After thirteen and one half hours of labor the cervix had dilated to six centimeters, but the vertex, which had been floating at induction, failed to engage. She was then judged to have an inadequate pelvis and was sectioned for "failure to progress". The child did well.

Seventy-three (42.7%) of the 171 labors induced with ocytocin alone were precipitate. Eighty-one women (47.4%) had first stages of three hours or less, 144 (84.2%) (including the section noted above) were fully dilated at nine hours. One patient induced successfully with oxytocin had a first stage lasting more than twenty hours.

There were forty-one women who received oxytocin as the second part of a multiple try induction. Twenty-five or 61.0% went into labor within two hours. Two more went into labor within twenty-four hours. Nine inductions failed. Two of these nine gravidas went into labor spontaneously. Seven were induced with other measures

but labor was not produced within twenty-four hours of the use of oxytocin. Five patients, whose inductions were not counted as failures, were induced within twenty-four hours by an intervening measure. Oxytocin was used seven times as a third measure and in three cases failed to produce labor. It was used twice as a fourth measure, but was supplanted both times by a fifth procedure before labor ensued. Neither of these two were failures. Three of the labors induced by oxytocin as a third measure were precipitate. One labor lasted between six and nine hours. Twelve or 44.4% of the twenty-seven labors which were the result of the use of oxytocin as a second measure had first stages of less than three hours. Ten (40.7%) of them were precipitate. Another twelve of these twenty-seven patients were delivered between three and six hours and the remaining three or 11.1% were delivered between six and twelve hours.

Used a total of 265 times to induce labor, oxytocin failed to effect the desired result forty-two times (15.8%). Two hundred two labors were the direct result of an oxytocin infusion; 171 of these were induced with one attempt only; 164 of these 171 had latent periods of four hours or less. Seventy-five of these 171 labors were precipitate, while all but fourteen were fully dilated at nine hours. Thirteen

of the thirty one labors induced with oxytocin as the ultimate effort in a multiple try induction were also precipitate. All but three of these women had achieved full dilatation at nine hours. Two patients induced primarily with oxytocin came to cesarean section, but one of these women was sectioned two weeks after her induction had failed.

Sparteine Sulfate

Sparteine was used as the first inductive measure in sixty-eight of the 536 women (12.7%). Twenty-seven of these women went into labor within an hour (39.7%). Thirty-nine women were induced within two hours (57.4%). Forty-three began contracting effectively within four hours of their first injection with sparteine (63.2%). Two more were in labor at fourteen hours. Four gravidas (5.9%) failed to respond and went into labor spontaneously. In four women subsequent efforts at induction were made without labor being produced within twenty-four hours. Therefore, there was a total of eight failures (11.8%). Fifteen women (22.1%) who received sparteine first were induced within twenty-four hours by an intervening inductive attempt.

Sparteine was used as the second measure in seven women. In four of them it produced labor within four hours. The other three did not respond. Its use as a third measure twice has been noted in discussing the use of amniotomy.

In the group of forty-five labors successfully induced with sparteine alone there were two cesarean sections. One was performed on a nullipara, #1342, who entered the hospital with membranes ruptured for eight hours. She responded to sparteine in one hour and was in labor for twenty-seven hours. Fetal bradycardia was then noted and she was sectioned. Her cervix had dilated to seven centimeters prior to the cesarean section. The other cesarean section was performed on a para ii, #1009, who went into labor promptly after being given sparteine. Within thirty minutes the fetal heart rate dropped to seventy and fresh meconium was passed. Emergency cesarian section was performed.

Excluding the cesarean sections, twenty of forty-three (46.5%) full first stages after sparteine's use were completed in three hours, sixteen more in six hours (37.4%) and a total of forty (93.0%) were completed by nine hours. The remaining three women were fully dilated in less than twenty hours. Two of the four gravidas who received sparteine a second time with success had first stages shorter than two hours. The other two were fully dilated between three and nine hours after the start of labor.

Employed a total of seventy seven times, sparteine resulted in the induction of forty-five labors when used by itself, and in the induction of six more labors when used as the second or third part of multiple try inductions. It failed eleven times. Forty-nine of the fifty-one labors successfully induced with sparteine began within four hours of its use. Forty-six of the fifty-one labors which were the result of the use of sparteine were completed within nine hours. Two women who were successfully induced were subsequently delivered abdominally because of fetal distress, one within an hour of the onset of contractions, the other at twenty-seven hours.

METHODS OF ELECTIVE INDUCTION---UNIVERSITY SERVICE

On the university service 173 women underwent attempted elective induction of labor. Two hundred fifty-five different attempts were made to induce these women. Stripping of the membranes in order to achieve induction was done 131 times. Three women were induced with a combination of stripping and sparteine. In seven women the membranes were ruptured artifically in order to induce labor. In another three amniotomy was combined as a single measure

with an oxytocin infusion. One gravida received a combination of sparteine and amniotomy. Seventy-four attempts to achieve induction were made with oxytocin. Thirty-one attempts were made with sparteine sulfate. One parturient was induced with a combination of sparteine and an oxytocin infusion.

Stripping of the Membranes

Stripping of the membranes was the first inductive effort employed in 116 of the 173 university patients (67.1%). In seventy four (60.7%) it was the only technique used. Sixty-three patients were successfully induced with stripping of the membranes only (36.4%). Nineteen (16.4%) of the women for whom stripping was the first mode of induction used had latent periods of less than two hours. Thirty-two (27.6%) had latent periods of less than four hours. Twelve more patients responded to digital stripping within eight hours, bringing the total to forty-four (37.9%). The remaining nineteen who responded directly did so within eight to twenty-four hours. Thus sixty-three or 54.3% responded directly. Twenty-one or one third of the patients induced with stripping were fully dilated three hours after labor had commenced. Twenty-five others achieved full dilation at six hours (39.7%). An additional

eight first stages were completed in twelve hours, so that 85.7% were fully dilated within twelve hours. Four more patients were fully dilated at twenty hours. One of the remaining five gravidas, #0089, a nullipara with a soft, fully effaced, but undilated cervix, went into labor sixteen hours after induction. Her labor was terminated by cesarean section after twenty-three hours. It had been stimulated with a second stripping and an oxytocin infusion. However, she failed to progress past three centimeters dilatation. Her membranes had ruptured spontaneously after thirty minutes of labor and she became febrile. During labor fetal tachycardia had been noted. At section positive intrauterine cultures were obtained. Despite antibiotic therapy, the mother remained febrile for twenty-five hours. The other four patients who responded to stripping of the membranes (6.4%) were evenly divided between those whose labors lasted between twenty and twenty-four hours and those whose labors lasted more than twenty-four hours. Fifteen women or 23.8% of the gravidas induced with digital stripping of the membranes only had precipitate labors.

Ten of the women whose inductions failed had spontaneous labors ranging in length between one and twenty-four hours. The eleventh woman whose induction failed, #0191, went into labor spontaneously, but was delivered by

cesarean section twenty-four hours and twenty minutes later. At spontaneous rupture of the membranes meconium staining was noted. Oxytocin stimulation was begun at three centimeters dilation and the cervix dilated another three centimeters in the next three and one half hours. At this point fetal bradycardia, accentuated by attempting to compress the head into the pelvis, was noted. Cesarean section for suspected cephalopelvic disproportion was performed. The infant weighed 2440 grams and did well. Its cord had been trapped between its head and the pelvic brim. The mother had a positive intrauterine culture and was febrile four days despite antibiotic therapy.

Thirty-two or 18.5% of the university patients had their membranes stripped as the first portion of a double try induction. Twelve went into labor within twenty-four hours of the stripping. The stripping was not considered to have failed in these gravidas, but their labors and complications were considered to be more directly related to the second measure used. The other twenty women's strippings were considered failures as labor did not ensue within twenty-four hours. Ten more gravidas had their membranes stripped as the first of three or more tries at inducing labor. All but one of these strippings were failures. The one gravida whose stripping was not a failure went into labor within twenty-four hours after

two discrete courses of sparteine and an oxytocin infusion.

Eleven women had their membranes stripped as the second part of a multiple try induction. Four of these patients went into labor within three hours. Two more went into labor after latent periods of between ten and eighteen hours. One women went into labor after the use of an oxytocin infusion begun three hours after the stripping had been performed. The remaining four of these eleven second inductive attempts with stripping of the membranes failed. The patients on whom they had been performed were treated to subsequent inductive attempts.

One of the six gravidas in whom second attempt stripping succeeded had a precipitate labor. Four attained full dilatation between three and nine hours and the last one's first stage lasted over twenty-four hours.

There were three parturients whose membranes were stripped as the third or fourth part of their induction. One woman, (#0027), whose membranes had been stripped unsuccessfully and who had then received an unsuccessful oxytocin infusion, had her membranes stripped a second time four days later. This, too, failed. Two days later she was induced with an oxytocic infusion, given six and one half hours after a course of sparteine had been given without production of contractions. One patient, (#1337), in whom a previous stripping and a separate oxytocin infusion

had been used without success, had her membranes stripped a second time five and one half hours after a second oxytocin infusion had begun. Both failed. She was induced eventually with oxytocin and sparteine simultaneously, but not before a previous course of sparteine and a third oxytocin infusion had failed. A third gravida, who had been given two unsuccessful oxytocin infusions, had her membranes stripped twice, a day apart, as third and fourth efforts at induction. The first stripping was a failure, but the second stripping induced labor after a latent period of between three and four hours. Labor was completed between six and nine hours after its onset.

There were two women (1.2%) in whom stripping and sparteine were combined as a first measure. Both went into labor after latent periods of between six and ten hours. Both had first stages of between nine and twelve hours.

One patient was induced with a combination of stripping of the membranes and sparteine after a preceding stripping of the membranes had failed. She went into labor within two hours and was delivered between nine and twelve hours later. One other woman was induced with this combination after two strippings had failed. Her latent period lasted between fourteen and eighteen hours, but her labor was over within nine hours.

One gravida received a combination of stripping of the membranes and an oxytocin infusion first. This was supplanted after eighteen hours by a second oxytocin infusion which produced labor promptly. The first measure was considered contributory. One woman had an attempted induction with stripping of the membranes and oxytocin after a previous stripping had failed. This combination measure was supplanted by a second and then a third oxytocin infusion before labor was induced. However, labor did begin within twenty-four hours of the use of the combined effort. One gravida was successfully induced with this combination of stripping and oxytocin used as the third part of a triple try induction. Labor ensued promptly and lasted between three and six hours.

Forty-seven of 131 strippings of the membranes performed on university patients did not result in labor. In seventy instances labor could be considered the direct result of stripping of the membranes. The latent periods in these seventy instances were frequently long. Thirty-one were over four hours in length and twenty-five were more than eight hours long. Sixteen of the seventy labors produced were precipitate. Ten of them lasted more than twelve hours.

Amniotomy

Four women (2.3%) on the university service were induced with amniotomy alone. All four had latent periods of less than four hours. Three had precipitate labors and the fourth was delivered within six hours of the start of labor. Two other patients had their membranes ruptured as the second part of their induction. Both went into labor within the hour and were fully dilated within two hours. One of these two gravidas was fully dilated for over an hour before delivery was accomplished. A seventh gravida had her membranes ruptured as the third attempt to induce her. She went into labor within the hour and was fully dilated after between nine and twelve hours of effective contractions.

Two women or 1.7% were considered to have had combined amniotomy and oxytocin inductions since the two measures were instituted within one hour of each other. Both were in labor at one hour and both had precipitate labors. One patient was given oxytocin and had her membranes ruptured as the third part of a four part induction. A subsequent oxytocin infusion was administered before labor began. One patient had a combined induction with amniotomy and intramuscular sparteine.

She began to contract effectively within one hour and was delivered within three hours. No university patient on whom amniotomy was performed had a latent period of more than four hours, including the one woman on whom a subsequent measure was used. Seven of the eleven women in whom amniotomy was directly responsible for habor had precipitate labor..

Oxytocin

Oxytocin was used by itself as a first measure in thirty (17.3%) of the university patients. In twenty-one (70.0%) it produced labor on its own within twenty-four hours. Half of the women induced first with oxytocin were in labor in two hours. Three more or 10.0% had latent periods of between two and six hours. The remaining three successful inductions began after latent periods of between eight and twenty-four hours. Three women who received oxytocin first (10.0%) were successfully induced within twenty-four hours of the start of the oxytocin infusion by a subsequent measure. Six (20.0%) inductions with oxytocin failed. All six had subsequent attempts at elective induction, five of which succeeded. One patient went into labor spontaneously after all attempts at

induction had failed.

Four or 19.0% of the twenty-one labors induced with oxytocin alone were precipitate. Five patients (23.8%) had first stages of three hours or less. Fourteen (66.7%) were fully dilated at six hours and all twenty-one were fully dilated in nine hours.

There were twenty-nine women who received oxytocin as the second part of a multiple try induction. Twenty-one or 72.4% went into labor within three hours. Labor was achieved in one patient within twenty-four hours, but only after the use of a second infusion as the third part of a triple try induction. Seven infusions failed; all seven patients had subsequent attempts at induction. Five of these women eventually went into labor as the result of their obstetrician's inductive efforts. Two failed to go into labor after multiple inductive efforts, were discharged, and went into labor spontaneously sometime afterwards. The twenty-one labors which were the result of the use of oxytocin as a second measure included seven (33.3%) with first stages of less than three hours, six of which were precipitate. Another seven patients were fully dilated between three and six hours. Five parturients or 23.8% were delivered between six and twelve hours after the onset of labor. Two had labors of between twelve and twenty hours.

Oxytocin was used nine times as a third measure and in five cases failed to produce labor. A sixth gravida was induced within twenty-four hours by a subsequent oxytocin infusion. The three patients successfully induced went into labor within two hours. All three had labors of less than six hours. One had a precipitate labor.

Oxytocin was employed five times as a fourth measure and succeeded in inducing labor in all five patients. Three women began to dilate within the hour. The fourth had a latent period of between three and four hours and the fifth had a latent period of over ten hours. Two of these five patients had precipitate labors. Two more were fully dilated at six hours and the last had a first stage which lasted between twelve and sixteen hours.

Oxytocin was used once as a fifth measure. Labor ensued within the hour and was completed in exactly three hours.

In seventy-four instances where oxytocin was used for elective induction, labor was achieved directly in fifty-one patients. Oxytocin failed to induce labor eighteen (24.3%)times. Fourteen of the fifty-one labors induced with oxytocin were precipitate. Four patients had first stages of more than twelve hours in duration.

Sparteine Sulfate

Sparteine was used as the first inductive measure in seventeen of the 173 women (9.8%). Eight gravidas were induced within two hours (47.1%). Eleven patients began contracting effectively within twenty-four hours of their first injection with sparteine (64.7%). Three women induced with sparteine failed to respond and went into labor spontaneously, one of them after two subsequent oxytocin infusions had failed to produce labor. Two other parturients were successfully induced with other measures within twenty-fours hours of the use of sparteine. One patient, #0091, induced with sparteine ninety minutes after premature spontaneous rupture of the membranes, did not go into labor within the ensuing twenty-one hours. Twenty-two and one half hours having lapsed since rupture of the membranes, and the question of a placenta previa having been raised subsequent to induction, she was delivered abdominally. There was no labor. The infant was premature and its Apgar scores were depressed at both one and five minutes. The mother became febrile twnety-nine hours postpartum and her temperature remained elevated for two days. The etiology of the fever was established. It was attributed to a urinary tract infection.

Four of the eleven women induced successfully with sparteine were delivered in three hours, (36.4%). Four more were fully dilated by six hours and all were delivered in nine hours.

Sparteine was used as the second inductive measure in eleven university patients. Nine of these gravidas went into labor within two hours. One of the other two was induced with amniotomy and two oxytocin infusions within three hours of the use of sparteine. The other was given a second dose of sparteine about five hours later and when this did not produce labor promptly, was administered an oxytocin infusion. This produced labor. One gravida was given sparteine as the fourth part of a five-try induction. Labor was produced seven hours later by an intervening oxytocin infusion. Sparteine was used in one other university patient. It was given her as the first indicated effort at induction after four earlier elective efforts had failed a week before. Sparteine failed too.

Two of the nine women induced successfully with sparteine as the second measure had first stages of less than three hours. Three more achieved full dilatation between three and six hours. Two other patients were fully dilated after first stages of six to nine hours. The eighth was in labor between twelve and sixteen hours and the ninth was in labor more than twenty-four hours.

Sparteine was used thirty-one times. It failed to produce labor four times. A latent period of twenty-one hours was terminated in one patient by cesarean section. Labor was the direct result of sparteine's use in twenty patients, eight of whom were induced within four hours of its administration. Six of these twenty women had precipitate labors; eighteen had labors of less than nine hours. One patient was delivered after a labor of between sixteen and twenty hours and one gravida was in labor over twenty-four hours.

STIMULATION OF LABOR---BOTH SERVICES

On the general service 167 women had their labors stimulated once contractions had been established (31.2%). In ninety-four of these women this stimulation was amniotomy. In fifty-five it was an oxytocin infusion.

On the university service forty-three women had their labors stimulated once contractions had been established (24.9%). In twenty-six of these women this stimulation was amniotomy. In ten it was an oxytocin infusion.

STATUS OF THE CERVIX AT INDUCTION---GENERAL SERVICE

On the general service 493 women had their cervices described at the time induction was initially attempted. In the remaining forty-three, (8.0%), the status of the cervix was either unknown or not stated in the record. Among the women in whom at least partial description of the cervix was made there were two women whose cervices were described as soft and fully effaced, but whose dilatation was not noted. There were 318 women whose cervices were not described in terms of effacement. Three of these were reported to have firm cervices and 125 were said to have soft cervices. Sixty of these 318 were said to have cervices dilated zero to one centimeter. One hundred sixty-five were dilated two centimeters. Sixty-eight had cervices dilated three centimeters and twenty-six were four or more centimeters dilated.

There were 175 cervices whose effacement was noted. One hundred sixty-three or 93.1% were 50% or more effaced; eighty-two or 46.9% were 75% or more effaced. All but three of 143 cervices whose consistency was noted were considered soft.

In terms of dilatation forty-five or 8.5% were not described. Eighty-eight or 16.4% were undilated or one centimeter dilated. Twenty of these eighty-eight were

considered better than 50% effaced and twenty-five were considered soft. Two hundred fifty or 46.5% of the women induced were reported to have cervices dilated two centimeters at induction; 110 or 20.5% were said to be three centimeters dilated, while forty-three or 8.1% were four or more centimeters dilated.

The latent periods after induction were compared with dilatation of the cervix at induction. Only the 491 women in whom dilatation was stated were compared. There were 320 women (60.0% of 536) who, regardless of the measure used first, had latent periods of less than one hour. Seventy-five women or 14.0% had latent periods of one to two hours. Nineteen gravidas had latent periods of two to three hours; ten had latent periods of three to four hours. Thus 424 women had latent periods of four hours or less (79.1%). Forty-four or 50.0% of the women with cervices dilated zero to one centimeter had latent periods shorter than one hour. Fifty-hine or 67.0% of the women with zero to one centimeters dilated cervices were in labor four hours after induction. One hundred thirty-nine or 55.6% of the patients with cervices two centimeters dilated had latent periods of an hour or less; 77.2% or 193 gravidas with cervices two centimeters dilated had latent periods of less than four hours; 75.2% or 115 of 153 women with cervices of three centimeters or more

dilatation were in labor within an hour of induction. Ninety-two point two per cent of these women were in labor in four hours. Forty-four of the first 536 inductive attempts or 8.2% were considered failures. Nineteen of the women with cervices less than two centimeters dilated had failed inductions.(21.6%). Twenty-two of the women with cervices two centimeters dilated had failed inductions (8.8%). Two of the 153 women with cervices three centimeters or more dilated had failed inductions (1.3%0.

There were 443 gravidas in whom labor was successfully induced and completed after just one measure. Two hundred thirty two or 52.4% of these labors were precipitate. Though patients with cervices three or more centimeters dilated comprised only 32.3% (143) of this group of women, they accounted for 105 or 45.3% of the precipitate labors. Women with cervices of less than two centimeters dilation comprised 13.5% (60) of the group of 443, but only 6.9% (16) of the patients whose labors were precipitate. Women with cervices two centimeters dilated numbered 207 or 46.7% of the total and 43.5% of the precipitate group.

The more widely dilated a patient's cervix was at the time of induction, the more likely she was to respond to induction, to have a short latent period and to experience a shorter labor. The incidence of failed inductions was decreased among gravidas whose cervices were

three or more centimeters dilated. These same patients had short latent periods and precipitate labors far more frequently than did the women with less dilated cervixes.

There were sixty-eight women on the general service who received at least a second measure before they were successfully induced. Seven of their cervices were not described and their cervical status at induction could not be reliably inferred from previous and subsequent examinations.

In this group there were also two women whose cervices were not described in terms of dilatation, but were classified as soft or better than 50% effaced. Forty-one patients were not described in terms of effacement. One of these cervices was considered firm and twenty-three were reported as soft. Five of them were reported as less than two centimeters dilated, twenty-five as two centimeters and six as three or more centimeters dilated.

There were fifty-nine patients in whom cervical dilatation was described (86.8%). Fourteen were reported to be zero to one centimeter dilated (20.6%); four of these were considered soft; five were considered better than 50% effaced and one was considered less than 25% effaced. Thirty-five women had cervices two centimeters dilated (51.5%) and ten were three or more centimeters taken on each [illegible] had shown latent [illegible] frequently [illegible]

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In this group [illegible]

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There were [illegible] to be [illegible] these were [illegible] dilated (14.7%). Cervical status was compared again with the latent periods. Thirty-four or 50% of these sixty-eight gravidas went into labor within one hour of the use of a second measure. All but three of the ten women with cervices dilated three centimeters or more did so (70.0%). These seven women comprised 20.6% of the group with such latent periods. Fifteen or 42.8% of the gravidas with cervices two centimeters dilated were in labor within one hour. Seven gravidas with less dilated cervices had latent periods of less than one hour. Forty-five women (66.2%) had latent periods of four hours or less. This included eight of the women with three centimeter dilated cervices, twenty-three (65.7%) of the women with cervices dilated two centimeters, and ten of the women with the undilated or one centimeters dilated cervices. There were thirteen failed second induction attempts, 19.1% of the second inductions. This brought the total number of failed attempts to fifty-seven in forty-four women. Six of these thirteen gravidas with failed inductions were given a third measure to induce them. Seven had spontaneous labors. There were seven women in this group of sixty-eight double try inductions in whom a third effort was made to achieve induction and labor ensued within twenty-four hours of the second measure. These seven included the one patient

with a cervix three or more centimeters dilated who was not induced successfully with a second measure.

There were forty-eight labors successfully induced in this group of double try inductions without the use of a third attempt (70.6%). Twenty-three of them (47.9%) were precipitate. Four of the nine gravidas with cervices three centimeters or more dilated whose labors had been induced with a second try had precipitate labors (44.4%). Twelve of the twenty-five women with cervices two centimeters dilated who were successfully induced had precipitate labors (48.0%).

The sixty-eight patients in whom a second attempt was made to achieve induction included forty-five gravidas whose labors began within twenty-four hours of the first attempt. Three of these forty-five had three part inductions. All the women in this group whose cervices were described as three centimeters dilated were successfully induced.

Thirteen or 2.4% of the 536 women electively induced on the general service received three or more separate inductive attempts. In this group there were two nulliparas, two para i's, eight paras ii-iv, and one grand multipara. Three women's cervices were not described at all prior to their third induction attempt. Nine

gravidas did not have their cervices described in terms of effacement. Three of these nine patients were described respectively as having a firm, two centimeters dilated cervix, a soft, two centimeters dilated cervix and a soft, three centimeters dilated cervix. One of the other six not described in terms of effacement was three centimeters dilated, another two were two centimeters dilated. Three of the four cervices whose effacement was described were three quarters effaced. One was less than a quarter effaced. Three of the four cervices whose consistency was reported were soft. One was firm. Ten cervices' dilatation were noted. Of these, two were zero to one centimeter, six two centimeters, and two three centimeters dilated.

Eight of these thirteen women had latent periods of three hours or less. One patient, a woman whose cervix was not described, had a latent period of between six and eight hours. The other four women's third measures were considered failures, bringing the total number of failures to sixty-one in forty-four women. Two of these four women went into labor spontaneously. Two received further inductive measures and are described below.

It is noteworthy that three of these thirteen women who were induced with separate attempts received all three attempts within seven hours and were all in labor within

eight hours of the start of the first measure. All three had precipitate labors. There was one other woman in this group of thirteen whose labor was precipitate. Her cervix had not been described.

Three other gravidas among these thirteen were worthy of special note. The first, a para ii, received an oxytocin infusion in an attempt to induce her electively. Her cervix was then described as dilated zero to one centimeter . The vertex was presenting at station minus three. This infusion was discontinued after less than two hours. It failed to produce labor. She was discharged and readmitted subsequently with ruptured membranes for more than twenty-four hours. She received a second oxytocic infusion between four to six hours in length. It, too, failed to produce labor. Over eighteen hours after this second infusion had been started, a third one was begun, and she went into labor within one hour. The first of the three infusions was considered a failure. The third infusion was continued through delivery and for not quite an hour afterwards. Delivery was spontaneous after a labor of between two and three hours. The infant weighed between 3000 and 3500 grams and its Apgar scores were over seven. The mother had received antibiotics prophylactically because of ruptured membranes. Cervical and placental cultures were negative

and the puerperium was uncomplicated.

The second woman worthy of note was a para ii, whose cervix was not described at her first inductive attempt and whose fetus presented as a vertex, station unstated. She was admitted with a diagnosis of preeclampsia after four elective strippings of her membranes had failed to induce labor. Her history (#0080) has been noted earlier.

A third patient, (#0079), a para iv, whose vaginal findings were described as cervix zero to one centimeter dilated, vertex at minus one, was induced at thirty-four weeks after seven admissions for false labor and eight weeks of complaining of intractible nausea and vomiting, during which time she had continued to eat and gain weight. Thorough evaluation of her chart failed to elicit any definite medical or obstetrical indication for induction. Her membranes were stripped and at an undescribed interval an oxytocin infusion was begun which failed to induce labor. This first infusion was presumably discontinued almost at once, as a tetanic contraction of the uterus occurred shortly after the infusion was begun. She then received a second infusion for six hours and twenty-five minutes. This, too, failed. A third infusion was begun, but this was discontinued within four hours and she was sectioned without ever having been in labor. The infant weighed 1950 grams. It was one of the four infants weighing

less than 2000 grams delivered on the general service. This patient's infusion was classified as possibly contributory, for it could not be fully evaluated.

STATUS OF THE CERVIX AT INDUCTION---UNIVERSITY SERVICE

On the university service 167 patients had their cervices described at the time induction was initially attempted. In the remaining six (3.5%), the status of the cervix was either unknown or not stated in the record. One of two women whose cervical dilatation was not noted was described as having a firm, uneffaced cervix. The other patient's cervix was described as soft and fully effaced.

There were sixty-eight patients whose cervices were not described in terms of effacement. One of these women was reported to have a firm cervix, one to have a "softening" cervix, and thirty were said to have soft cervices. Six of these sixty-eight women were said to have cervices zero to one centimeter dilated. Forty-two had cervices two centimeters dilated, and fourteen patients' cervices were three or more centimeters dilated.

There were 105 cervices whose effacement was noted.

Ninety or 85.7% were 50% or more effaced. Forty-three or 41.0% were 75% or more effaced. All but four of forty-six cervices whose consistency was noted were considered soft.

In terms of dilatation eight or 4.6% were not described. Twenty-one or 12.1% were undilated or one centimeter dilated. Eleven of these twenty-one were considered better than 50% effaced and three were considered soft. One hundred two or 59.0% of the women induced were reported to have cervices dilated two centimeters at induction. Thirty-two or 18.5% were said to be three centimeters dilated, while ten or 5.8% were four or more centimeters dilated.

The latent periods after induction were compared with dilatation of the cervix at induction. Only the 165 patients in whom dilatation was stated were compared. There were thirty-three women or 19.1% of 173 who, regardless of the measure used first, had latent periods of less than one hour. Fifteen women or 8.7% had latent periods of one to two hours. Eleven gravidas had latent periods of two to three hours, five had latent periods of three to four hours. Thus, sixty-four women had latent periods of four hours or less (37.0%). Two or 9.5% of the twenty-one patients with cervices dilated zero to one centimeter had latent periods shorter than one hour.

Three or 14.3% of the women with zero to one centimeters dilated cervices were in labor four hours after induction. Fifteen or 14.7% of the parturients with cervices two centimeters dilated had latent periods of an hour or less; 30.4% or thirty-one women with cervices two centimeters dilated began labor within four hours. Sixteen or 38.0% of forty-two gravidas with cervices of three or more centimeters dilatation were in labor within an hour of induction. Two-thirds of these women were in labor in four hours. Fifty of the first 173 inductive attempts (28.9%) were considered failures. Twelve of the patients with cervices less than two centimeters dilated (42.8%) had failed inductions. Thirty-one of the women with cervices two centimeters dilated (30.4%) had failed inductions. Three of the forty-two women with cervices three centimeters or more dilated had failed inductions (7.1%).

There were 103 gravidas in whom labor was successfully induced and completed after just one measure. Twenty-nine or 28.2% of these labors were precipitate. Though women with cervices three or more centimeters dilated comprised only 31.1% (32) of this group of patients, they accounted for fifteen or 51.7% of the precipitate labors. Women with cervices of less than two centimeters dilation comprised

6.8% (seven) of the group of 103, but only 6.9% (two) of the women whose labors were precipitate. Women with cervices two centimeters dilated numbered sixty-two or 60.2% of the total and 41.4% of the precipitate group.

There is a marked difference between the response to induction of women whose cervices were three centimeters dilated and the response of those with less dilated cervices. While 30.4% of women with cervices of two centimeters dilatation are in labor four hours after induction, 66.7% of the patients with cervices of three centimeters or more dilatation are contracting effectively at this point. Similarly the gravidas with more widely dilated cervices are disproportionately represented in the group with precipitate labor.

There were fifty-five women on the university service who received at least a second measure before their labors commenced. Four of their cervices were not described and their cervical status at induction could not be reliably inferred from previous or subsequent examinations. There were two women whose cervices were not described in terms of dilatation, but were described in other parameters. One of these two gravidas' cervices was classified as soft and three-fourths effaced. The other's was considered less than one-fourth effaced. Nineteen patients' cer-

vices were not described in terms of effacement. Ten of these nineteen women's cervices were noted to be soft. Two of them were reported as less than two centimeters dilated, ten as two centimeters dilated, and two as three or more centimeters dilated.

Thirty-three of the thirty-six cervices whose effacement was described were better than 50% effaced. Fifteen were 75% or more effaced. All but one of nineteen cervices whose consistency was noted were considered soft.

There were forty-nine patients in whom cervical dilatation was described (89.1%). Eight were reported to be dilated zero to one centimeter (14.6%). Thirty-five women were considered to have cervices two centimeters dilated (63.6%) and six were said to be three or more centimeters dilated (10.9%). Cervical status was compared again with the latent periods. Twenty-four or 43.6% of these fifty-five gravidas went into labor within one hour of the use of a second measure. All patients with cervices dilated three centimeters or more did so. These six women comprised 25.0% of the group with such short latent periods. Fourteen or 40.0% of the women with cervices two centimeters dilated were in labor within one hour. Two gravidas with less dilated cervices had latent periods of less than one hour. Thirty-seven patients (67.3%)

had latent periods of four hours or less. This included all of the women with three centimeters dilated cervices, twenty-three (65.7%), of the women with two centimeters dilated cervices and four of the women with the undilated or one centimeter dilated cervices. There were eleven failed inductions, 20.0% of the second attempts. This brought the number of failed attempts on the university service to sixty-one in fifty patients. All eleven of these gravidas whose second inductions failed had subsequent attempts at induction. Five others who had received two discrete attempts at induction received a third which produced labor within twenty-four hours of the initiation of their second attempt.

There were thirty-nine labors successfully induced in this group of double try inductions without the use of a third attempt (70.9%). Ten of them (25.6%) were precipitate. Three of the six gravidas with cervices three centimeters or more dilated had precipitate labors. Four of the twenty-five women with cervices two centimeters dilated who were successfully induced had precipitate labors. (16.0%).

Eighteen of the women who received a second attempt at induction were induced within twenty four hours of their first effort. The response of the patients whose cervices were three centimeters dilated was again noticeably

better than that of the women whose cervices were less dilated. The former group's latent periods were shorter and not one of them failed to respond to induction, though 22.4% of the other forty-nine patients had unsuccessful second attempts.

On the university service sixteen (9.2%) women received three or more inductive efforts, two of them within twenty-four hours. This included three nulliparas, three para i's, six para ii's and four grand multiparas. All had their cervices described in at least one way. Six patients were not described in terms of effacement or consistency. The remaining ten had cervices described as 25-50% effaced (two), 50-75% effaced (three), and 75% or more effaced (five). Six cervices were considered soft. Three cervices were described as zero to one centimeter dilated, one of them being described as soft. Nine were considered to be two centimeters dilated, three to be three centimeters dilated. Six of the gravidas who received three measures were induced within twenty-four hours without any further intervention. Five of the six had latent periods of less than two hours. Three more patients were in labor within twenty-four hours, but subsequent measures were used prior to the onset of labor. Seven failed to go into labor, bringing the total number of failures to sixty-eight in fifty women. Three of these

seven patients went into labor spontaneously, one after a fourth measure had failed. The other four were successfully induced with further efforts.

Two gravidas among the eight who had just three measures were each stripped electively without success. Subsequently they were admitted for induction because of postmaturity. They were both stripped a second time without success and induction was achieved with a combination of stripping and oxytocin in one, stripping and sparteine in the other. One went into labor within an hour of the start of an oxytocic infusion. Her labor was complicated by passage of meconium during the early part of the first stage but was otherwise unremarkable. The infant was not depressed at birth. The patient who received sparteine as part of the third measure had a cervix three centimeters dilated at that time, but did not go into labor for over fourteen hours. Her labor lasted between six and nine hours. She was delivered of an infant weighing between 2500 and 3000 grams. She had a postpartum hemorrhage of between 500 and 1000 ml. Oxytocin had been given intramuscularly at the end of labor.

A third patient in this group of eight received first 600 mg. of sparteine in divided doses and then a two to four hour oxytocin infusion to no avail. These measures were employed in the belief that her membranes had been

ruptured more than twenty-four hours. It was then discovered that the membranes were intact and she was rested between fourteen and eighteen hours before a second oxytocin infusion was given, this time electively. Although her cervix was three centimeters dilated at the start of elective induction, she failed to go into labor and was discharged. Labor began spontaneously and was characterized by a transient episode of fetal bradycardia early in the first stage. It was otherwise unremarkable.

There were eight patients in whom a total of three inductive efforts were made. Six had failed to respond to previous stripping of the membranes, three to earlier oxytocin infusions, and one to sparteine. Their cervices at the time of induction were described in four cases as dilated two centimeters, in two instances as less dilated and in two instances as more dilated than two centimeters. The third effort failed in two of these women. Five of the other six responded within two hours. One had a precipitate labor. This group included two women whose induction had become indicated after earlier elective attempts had failed. Both were successfully induced.

There were eight patients or 4.6% of the total number who received a fourth inductive measure. Three of these patients had soft cervices, three were said to be 50-75%

effaced, one to be 75% or more effaced. One woman was described as having a cervix one centimeter dilated. Six were described as two centimeters and one as three centimeters dilated. Three were grand multiparas, one was nulliparous.

Among these eight was one grand multipara (#0014) whose membranes were stripped electively. Her cervix was described initially as undilated, soft and better than 75% effaced. She became febrile and was given antibiotics. Between four and six hours after the stripping, she was given 150 mg. of sparteine in an effort to shorten her latent period. This and subsequent measures were considered indicated because of her temperature elevation. After an interval of four to six hours had elapsed without labor beginning, she was given another 150 mg. of sparteine. A little more than an hour was allowed to elapse and an oxytocin infusion was begun. Within four hours labor ensued. It lasted between nine and twelve hours. During the early part of the first stage, the fetal heart rate was noted to be irregular, and during the second stage the rate fell below eighty and meconium was passed. The infant was delivered with low forceps and weighed between 3500 and 4000 grams. It was not depressed at birth. Cervical cultures were read as positive and antibiotic therapy was continued through the puerperium. The patient

exhibited no temperture morbidity. Since twenty-four hours had not elapsed between the initial stripping and the onset of labor, all measures were considered possibly contributory to induction.

A para i, #0043, in this group of eight received two oxytocin infusions without success. Subsequently her membranes were stripped twice in order to induce her because of postmaturity. The first failed, the second produced labor after a latent period of between three and four hours. Labor lasted between six and nine hours and was complicated by fetal bradycardia in the early first stage. The baby weighed between 2500 and 3000 grams and was not depressed at birth.

A third woman in this group, a para ii-iv, received three oxytocin infusions electively, the first two separated by over fourteen hours, the third by approximately five hours. All were to no avail. Subsequently she was induced with a fourth infusion because of postmaturity. This time labor ensued within an hour, though her cervix had not changed in dilatation from the previous effort. Labor was precipitate but otherwise the infant's and her course were uncomplicated. The first three infusions were considered failures.

A fourth patient, #1341, had her membranes stripped electively and during the next thirty-six hours received

two oxytocin infusions without the production of labor. She was discharged. Her cervix was described as two centimeters dilated at the time of these three efforts. She was readmitted with membranes ruptured more than twenty-four hours and given a third oxytocin infusion. Between ten and fourteen hours after this infusion had been started she went into labor. Labor lasted five and one half hours. A minor perineal laceration occurred. She had positive cervical cultures on admission, was put on antibiotics prophylactically, and exhibited no puerperal morbidity.

The fifth woman in this group, #0027, a para v, had her membranes stripped electively and nearly four hours later was given an oxytocin infusion which failed to induce labor. She was discharged. Her membranes were stripped again in clinic, without result. Her cervix was described at the start of each of these three efforts as 50% effaced and two centimeters dilated. She was admitted with ruptured membranes two days later and nineteen hours after they had ruptured she was given the first of three 150 mg. injections of sparteine sulfate. Six and one half hours later an oxytocin infusion was begun and labor ensued within thirty minutes. The labor thus produced was unremarkable. However, the infant required an exchange transfusion because of unexpected ABO sensitization. It died the following day, the only fetal death

in the entire series.

The cervix of the sixth patient in this group, a para ii-iv was described as firm and less than 25% effaced when the first inductive effort was made. Her membranes were stripped. After nearly twenty-one hours she was given an infusion of oxytocin. Another twenty-two and one half hours were allowed to lapse and a second oxytocin infusion was started. Five and one half hours later she was stripped a second time and still no labor was produced. She was discharged and returned eight days later with membranes ruptured for seventeen hours. She was given three 150 mg. doses of sparteine. When seven hours had elapsed after the first dose without any sign of labor, she was given an infusion of oxytocin. This was run for between six and eight hours, but did not produce labor. The patient was rested and, nineteen and a quarter hours after the third oxytocin infusion had been started, a fourth infusion was begun. When this did not produce labor, a second course of sparteine was started to supplement the infusion and this finally produced effective contractions. The first five efforts to induce her were considered failures. The third oxytocin was considered possibly contributory and the last infusion and the second course of sparteine were considered a combined effort because of the short lapse of time between their institution. Both were continued into labor. The first stage lasted

ten hours. She was delivered with low forceps of a mature infant. Meconium was noted on sterile vaginal exam early in the first stage and the infant was depressed at birth with Apgar scores of one to three at one minute and four to six at five minutes. It did well. Proteus was cultured from the cervix prior to delivery and the mother was treated with tetracyline. She did not become febrile.

The seventh woman, a nullipara with a soft cervix dilated two centimeters, had her membranes stripped without success. Thereafter she had her membranes stripped and at the same time the first of three oxytocin infusions was begun. The third one produced labor which lasted between twelve and sixteen hours. Labor was uncomplicated and the infant did well. However, the cervix was lacerated during delivery. The oxytocin infusion had been discontinued shortly after labor had begun.

The eighth patient, #0098, was a grand multipara with a cervix one third effaced and two centimeters dilated. She was admitted with leaking membranes. The membranes had been leaking for six hours when she was given the first of two 150 mg. doses of sparteine. The second was given fifteen hours later and then two further efforts were made to induce her with oxytocin infusions. At the start of the first infusion the fetal heart rate dropped to sixty beats per minute. The infusion was stopped and

amniotomy was performed. The fetal heart rate returned to normal and the second infusion was begun two and one half hours after the first had been discontinued. Labor began promptly, lasted two hours and forty minutes and was uncomplicated.

There were eight women in whom four or more measures were used. Two of these were induced within twenty-four hours of their first inductive attempt. This group included one woman with an undilated cervix, six with cervices two centimeters dilated, and one with a cervix three centimeters dilated. This last woman had had three previously failed inductions and her latent period after the fourth induction was prolonged. Two patients failed to respond to the fourth measure. One of these two went into labor spontaneously. Five patients had latent periods of less than four hours. Two gravidas in whom induction had become indicated received more than four inductive attempts. The only neonatal death in the entire series occurred in one of these two cases.

STATION AND PRESENTATION---GENERAL SERVICE

Five hundred eight of the 536 women induced on the general service had vertex presentations, (94.8%) at induction. Eight presented as breeches, (1.5%). Two, (0.4%) had compound presentations. Both of these were induced with sparteine. In fourteen others the presentation was not known or not stated. One patient with a compound presentation responded to sparteine between eight and ten hours after it had been administered. After a precipitate labor of between two and three hours duration she was delivered vaginally of an infant in vertex presentation. The other woman underwent amniotomy and received an oxytocin infusion ten hours after the sparteine had been given. At this time the fetus was described as a floating vertex. Labor was precipitate and fetal tachycardia was noted during the early part of the first stage. The infant was not depressed at birth and did well.

Five hundred nineteen of the 537 babies delivered vaginally (96.6%) were delivered in vertex presentation, eleven of them stated to be occiput posteriors. Fourteen (2.6%) were delivered as breeches. Six of these were twins. One set had not been diagnosed at the time of induction. One patient, #1024, was delivered abdominally

of a baby in breech presentation. This was the patient who, two weeks after a failed oxytocic induction, underwent cesarian section because of a transverse lie.

The station of the presenting part at the time of induction was recorded in 432 women (80.6%). Thirty-four (6.3%) were at plus one station; 108 (20.1%) at zero station; 140 (26.1%) at minus one station, and ninety-six, or 17.9%, at minus two. Thirty-one (5.8%) were recorded as station minus three or vertex dipping into the pelvis. Twenty-three or 4.3% were recorded at station minus four or unengaged. Thus 26.4% were known to have the presenting part engaged and at the ischial spines or lower and 70.4% were known to have fulfilled the minimal criteria of station minus two.

STATION AND PRESENTATION---UNIVERSITY SERVICE

One hundred fifty-five of the 173 women induced on the university service, 89.6%, had vertex presentations at induction. Four presented as breeches, (2.3%). Compound presentation was suspected in one patient. She was induced with oxytocin. This failed. At the time of the

second attempt the fetus was presenting as a vertex.

One hundred sixty-five of the 172 babies delivered vaginally, 95.9%, were delivered in vertex presentation, eight of them stated to be occiput posteriors. Six babies or 3.5% were delivered as breeches. Two of the six breeches were twins. One infant was delivered as a face presentation.

The station of the presenting part at the time of induction was recorded in 142 women (82.1%). None were at plus one station. Fifteen, or 8.7%, were at zero station. Thirty-three, or 19.1%, were at minus one station, and forty-three (24.9%) were at minus two. Twenty-three (13.4%) were recorded as station minus three, or vertex dipping into the pelvis. Twenty-eight, or 16.2%, were recorded as engaged at minus four or as having the presenting part floating. Thus, 8.7% of the university patients were known to have the presenting part engaged at the level of the ischial spines and 52.7% were known to have fulfilled the minimal criteria of station minus two or lower set by most authors before they will perform elective induction.

PARITY---GENERAL SERVICE

On the general service eighty-one of 536 women electively induced or 15.1% were nulliparas. Twenty-five patients were para v or more. They comprised 4.7% of the series of induced private obstetrical patients. One (1.2%) of the eighty-one nulliparas, #1342, who had been induced with sparteine was sectioned after twenty-seven hours of labor. Her case has been described elsewhere. Five of the multiparas (1.1%) were sectioned, one, #1024, two weeks after a failed induction, one, #0079, after numerous measures had failed to produce labor, one, #1009, after thirty minutes of labor, one, #0578, after five and three quarters hours of labor and one, #1294, after thirteen and one half hours of labor. Their cases have all been described elsewhere.

The length of the first stage of labor in all 534 patients who went into labor was compared with the patients' parity. Thirty or 37.0% of the nulliparas had first stages of less than three hours, twenty-two (27.2%) having precipitate labors. Fifty-six or 69.1% of the nulliparas were fully dilated within six hours, seventy cr 86.4% within nine hours. All but six nulliparas (7.4%) achieved

full dilatation within twelve hours. One of the remaining six (#1342) had labor terminated by cesarean section as previously mentioned. Two others were fully dilated by sixteen hours, one more by twenty, and one had a first stage of between twenty and twenty-four hours.

There were 430 paras i-iv. Four hundred twenty-eight went into labor. One labor, terminated at one half hour by section is not considered here. Two hundred and sixty-two or 61.4% had first stages of three hours or less; 225 precipitate labors, (52.7%). Three hundred eighty-four had first stages which were completed within six hours, (89.9); 407 were fully dilated within nine hours, including one in whom the first stage was terminated by cesarean section (95.3%); 415 or 97.2% had completed their first stage of labor in twelve hours. The remaining twelve included one woman sectioned at thirteen and one half hours, eight in labor between twelve and sixteen hours, (2.1%), and three delivered between sixteen and twenty hours.

Eighteen of the twenty-five grand multiparas (72.0%) had precipitous labors; all but one was delivered in six hours. The latter was in labor less than nine hours.

There were a total of 265 precipitate labors on the general service, (49.6%). Nulliparas comprised 8.3% of this group, while 85.3% of the precipitate labors occurred

in multiparas, paras i-iv, and 6.4% of them were grand multiparous labors. Six of the precipitate labors occurred in the 28 women whose labors were completely spontaneous in onset, induction having failed. There were eighteen first stages which lasted more than twelve hours, the incidence being 3.4%. One third of these lengthy labors were nulliparous.

Precipitate labor occurred most frequently in the grand multiparous patients and least commonly in the nulliparas. Precipitate and generally shorter labor appeared to be related to increase in parity. Prolonged labor seemed most common among the nulliparas. There was little difference in the incidence of cesarean section.

PARITY---UNIVERSITY SERVICE

On the university service thirty-nine of 173 women electively induced or 22.5% were nulliparas. Twenty-three women were para v or more. They comprised 13.3% of the series of induced university obstetrical patients. Two (5.1%), of the thirty-nine nulliparas, #0089 and #0191, were delivered abdominally. There were thirty-seven full nulliparous labors. One multipara, #0091, was delivered

by cesarean section. Her case has been described elsewhere.

The length of the first stage of labor in all 172 patients who went into labor was compared with the patients' parity. Four or 10.8% of the nulliparas had first stages of less than three hours, two or 5.1% having precipitate labors. Thirteen or 33.3% of the nulliparas were fully dilated within six hours; nineteen or 48.7% within nine hours. Twenty-seven (69.2%) achieved full dilatation within twelve hours and thirty-two or 86.5% were fully dilated at sixteen hours. Two of the remaining five had their labors terminated by cesarean section at twenty-three (#0089) and twenty-four and one third hours (#0191). One each of the other three was delivered between sixteen and twenty, twenty and twenty-four, and twenty-four and thirty-six hours.

There were 111 paras i-iv on the university service. One hundred and ten went into labor. One, #0091, was sectioned twenty-one hours after induction had been attempted without ever having been in labor. Forty of these multiparas or 36.4% had first stages of three hours or less; thirty-four or 30.9% having precipitate labors. Eighty-five multiparas had first stages which were completed within six hours (77.3%); 102 had achieved full dilatation within nine hours (92.7%);

104 or 94.5% had completed the first stage of labor by the end of twelve hours. The remaining six paras i-iv included two women who were fully dilated between twelve and sixteen hours, one each fully dilated between sixteen and twenty and twenty and twenty-four hours, and two women whose labors lasted between twenty-four and thirty-six hours.

Nine of the twenty-three grand multiparas or 39.1% had precipitous labors. Eleven were completely dilated within three hours or less (47.8%). Seven others achieved full dilatation between three and six hours after labor's onset (30.4%). Two more were fully dilated within nine hours and another two attained complete dilatation by twelve hours. Thus, all but one (4.4%) had achieved full dilatation at twelve hours. The last **grand** multipara completed her first stage between sixteen and twenty-hours after the onset of contractions.

There were a total of forty-five precipitate labors on the university service. The incidence of precipitate labor was 26.0%. Nulliparas comprised 4.4% of this group; 75.6% of the precipitate labors occured in multiparas, paras i-iv, while 20.0% of them were grand multiparous labors. Three of the precipitate labors occurred in the fifteen women whose labors were completely spontaneous.

There were nineteen first stages which lasted more than twelve hours, (11.0%). Ten of these labors were nulliparous.

On the university service precipitate labors were more frequent among the parous than the nulliparous. Precipitate labor was decidely less frequent on the university service.

SECOND STAGE OF LABOR---BOTH SERVICES

Sixty-four patients (12.1%) on the general service completed their second stage of labor within five minutes, while 379 gravidas completed their second stages between five and thirty minutes. There were eighty-seven gravidas 16.4%, with second stages of labor which lasted more than thirty minutes. Eleven (2.1%) women's second stages lasted more than one hour. Two patients' second stages lasted over two hours. One was a nullipara whose labor began spontaneously after a failed induction and the other was a woman successfully induced with an oxytocin infusion whose first stage had lasted over twelve hours. The nine women whose second stages of labor lasted more than one, but less than two, hours included four gravidas induced

with oxytocin only, one whose membranes were ruptured artificially, one induced with sparteine, one induced with a combination of amniotomy and oxytocin, and two whose inductions had failed.

On the university service thirty or 17.6% of the second stages of labor lasted five minutes or less and 114 or 67.6% lasted between five and thirty minutes. Twenty-six or 14.8% lasted more than thirty minutes. Nine (5.3%) of these were longer than one hour. One patient, a para ii, #1184, whose second stage lasted three hours and fifty-eight minutes, was induced with three 150 mg doses of sparteine sulfate. Labor commenced thirteen hours later. The first stage lasted seven hours and ten minutes. During the latter part of the first stage the anterior cervical lip was described as edematous and holding up the head. The fetal heart rate was noted to be above 160 during the end of the first and through the early part of the second stage. Following delivery of the head shoulder dystocia occurred. The infant was depressed at birth with an Apgar score of one to three at one minute. However, the Apgar score improved to better than seven at five minutes. The cervix was lacerated during delivery.

There were two women with second stages lasting between one and two hours whose inductions had failed.

Two parturients with similarly long second stages had been induced with stripping of the membranes. One gravida with a prolonged second stage had been induced with an oxytocin infusion and subsequent amniotomy. Another prolonged second stage occurred during the labor of a patient who had been induced with amniotomy after two oxytocin infusions had failed. The eighth prolonged second stage occurred in a woman induced with oxytocin after a previous failed oxytocin infusion and failed stripping. The ninth occurred during the labor of a patient in whom stripping of the membranes had failed to produce labor and who had then been given three oxytocin infusions before labor ensued. The last infusion was discontinued at the start of the first stage. All but two of these nine women had first stages six hours or longer.

THIRD STAGE OF LABOR---BOTH SERVICES

On the general service there were two women in whom the third stages of labor lasted longer than thirty minutes, an incidence of 0.37%. One occurred in a labor induced with an intravenous infusion of oxytocin run

for a little more than one hour. The first stage of labor lasted thirteen hours. The second occurred in a woman whose membranes had been ruptured artificially. She had been given 150 mg. of sparteine during the second hour of her latent period. Full dilatation was achieved within two hours. Excessive blood loss was not noted in either case.

There were no prolonged third stages on the university service.

METHOD OF DELIVERY---BOTH SERVICES

There were 543 live births on the general service. Six patients (1.1%) were delivered by cesarean section. There were fourteen breech deliveries (2.6%). One hundred fifty-three parturients with vertex presentation were delivered with forceps (28.2%). There were seven sets of twins, an incidence of 1.3%. The incidence of twins on the general service as a whole for the same two year period was 1.0%, the incidence of breeches 3.6%, the incidence of cesarean section 4.9%, the incidence of forceps deliveries 34.5%.

On the university service three of 173 deliveries were cesarean sections, an incidence of 1.7%. There were six breeches (3.5%), eighty-eight or 50.9% forceps deliveries and seventy-eight spontaneous deliveries (43.9%). There were two sets of twins, an incidence of 1.2%. The comparable figures for the entire university service for the same two year period were 5.0% incidence of cesarean section, 3.8% incidence of breech delivery, 32.0% incidence of forceps deliveries and 1.5% incidence of twins.

MATERNAL MORTALITY, UTERINE RUPTURE

There were no maternal mortalities or uterine ruptures on either service.

MATERNAL COMPLICATIONS---GENERAL SERVICE

Tetanic Contractions

There were two tetanic contractions on the general service. The incidence of uterine spasm was 0.37%. The first was a contraction of ninety to ninety-five seconds which occurred at the start of an oxytocin infusion. This had been used as the second inductive measure in a woman who received two more or a total of four infusions and was then sectioned without true labor (#0079). The second was a three and one half minute contraction which occurred forty-five minutes after amniotomy and the start of an oxytocin infusion. The infusion was discontinued and the contraction was broken with intravenous epinephrine. There was no sign of fetal distress, but, when the infant was delivered, its cord was wound once about its neck. Its Apgar score at one minute was below four. At five minutes the baby's Apgar score was not depressed.

Lacerations

The total incidence of perineal, vaginal and cervical lacerations on the general service was 12.5%. There were

thirty-four first and second degree perineal lacerations, twelve third and fourth degree lacerations, three of which involved the vagina as well, twenty-one vaginal lacerations, and ten cervical lacerations. In three women there were both vaginal and cervical lacerations and in one woman laceration of the vagina and cervix was combined with a third degree perineal tear. Excluding the thirty-one cases in which only minor perineal lacerations occurred, there were thirty six major lacerations, an incidence of 6.7%. The incidence of cervical lacerations was 1.8%. Eight of the ten women whose cervices were lacerated had received oxytocin as all or part of their induction. One of these eight inductions had failed. The ninth patient with a lacerated cervix had been induced with amniotomy. The tenth gravida had been induced with sparteine. One of these ten patients had been induced with a combination of amniotomy and oxytocin.

Though the incidence of cervical laceration was quite low on the general service, it was 33% higher among the women who had received oxytocin, occurring in 2.4% of the latter. Only two occurred in women with precipitous labors (0.8%). Eight occurred in patients delivered operatively (5.3%).

Postpartum Hemorrhage

There were twenty-two postpartum hemorrhages on the general service, an incidence of 4.1%. Seven of these involved the loss of between 500 and 1000 ml. of blood. Three involved the loss of more than one liter of blood. In twelve the quantity of blood lost was not known. One hemorrhage occurred in a woman whose induction with oxytocin had failed. The other twenty-one patients with postpartum hemorrhages included twelve who had been induced with a single infusion of oxytocin or oxytocin plus amniotomy, 4.4% of the women so induced. One postpartum hemorrhage occurred in a gravida whose induction had been attempted first with sparteine, then ten hours later with oxytocin. Another occurred in a patient whose membranes had been stripped without success. She had received three subsequent oxytocin infusions, the last one being terminated over eighteen hours before her labor was induced with amniotomy. In addition, her labor had been stimulated with intramuscular oxytocin. Two other patients, whose labors were stimulated with oxytocin, had postpartum hemorrhages. Thus, sixteen of twenty-two postpartum hemorrhages were related to the use of oxytocin (72.7%). There were 338 women who received oxytocin for

either induction or stimulation and 4.7% of these gravidas had postpartum hemorrhages. The other six hemorrhages were divided evenly among women who had been induced with sparteine or amniotomy. Postpartum hemorrhage was associated once with a minor perineal laceration and once with a cervical laceration. Seven women with postpartum hemorrhages had been given oxytocin intravenously following delivery. In the entire population of 536, 113 women had been given oxytocin intravenously after labor was completed.

Postpartum hemorrhage was more common among women with induced labors than in the general service population as a whole. The incidence among the latter was 3.0%. Excessive postpartum blood loss appeared to be frequently associated with the use of oxytocin.

Puerperal Morbidity

On the general service there were fourteen women whose temperature rose over 100.4° F. during the puerperium, an incidence of 2.61%. Only four patients had temperature elevations on more than one day. The incidence of standard puerperal morbidity, therefore, was only 0.75%. Two of the four patients with standard morbidity had been

delivered by cesarean section (#1294 and #1342). The latter, whose membranes had ruptured prior to induction, had a positive intrauterine culture at section, She was treated with broad spectrum antibiotics. Two of these four gravidas had no explanation for their fever. The fourth developed a urinary tract infection. The labor of one of the two women with an unexplained fever had been stimulated with amniotomy.

The etiology of six of the ten one day fevers was discovered. There was one urinary tract infection, one infected episotomy, two women with U.R.I's, and two with breast engorgement. Two of these ten women with one day fevers received specific antibiotic therapy. One patient with a one day fever of unexplained origin had been induced with a combination of amniotomy and oxytocin. Two others had been stimulated with amniotomy. The only case of postpartum fever in which the latent period exceeded two hours was the woman with an infected episiotomy.

A positive placental culture was obtained in one other gravida induced on the general service. No temperature elevation occurred and no antibiotics were given. Her membranes had spontaneously ruptured prematurely. Among the 522 patients who did not become febrile there were three cases of thrombophlebitis and five of urinary tract

infection. All five of the latter were treated with specific antibiotic therapy. One of the five had had an antepartum urinary infection. If one attributes the six fevers of unknown origin to pelvic infection[76] and excludes the woman with a positive placental culture but no fever, there were three women with standard puerperal morbidity and pelvic infection, an incidence of 0.56%, and seven women with pelvic infection sufficient to cause at least one day's temperature elevation (1.3%).

MATERNAL COMPLICATIONS --- UNIVERSITY SERVICE

Tetanic Contractions

There were two tetanic contractions on the university service, an incidence of 1.2%. One woman who had been induced with stripping of the membranes, but whose labor was stimulated with oxytocin, had two contractions lasting about ninety seconds. The second patient had several contractions more than one minute long at the start of labor. She was induced with sparteine. In neither instance was any neonatal depression apparent.

Lacerations

On the university service there were thirty lacerations, an incidence of 17.3%. Thirteen women had minor perineal lacerations,but one of these women had a cervical laceration as well. There were ten other cervical lacerations, one of them combined with a vaginal laceration. There were six additional vaginal lacerations and one major perineal laceration. Excluding the minor perineal tears, there were eighteen major lacerations, an incidence of 10.4%. One cervical laceration occurred after a labor induced with stripping of the membranes and stimulated with amniotomy and oxytocin. The patient was delivered operatively of a baby in face presentation, mentum anterior. Five cervical lacerations were associated with the use of oxytocin for stimulation in patients who had been induced with stripping of the membranes. The seventh cervical laceration occurred in a patient who received two courses of sparteine and two oxytocin infusions, one of which was combined with amniotomy, before labor was successfully induced. The successful oxytocin infusion was discontinued at three centimeters dilatation. The eighth case of cervical laceration was associated with induction with sparteine. Three other cervical lacerations

were associated with the induction of labor with oxytocin used by itself. One of these three patients had received three infusions prior to induction. Thus, ten of eleven lacerations of the cervix were associated with intravenous oxytocin for induction or stimulation of labor. The incidence of cervical laceration among women who had received ocytocin on the university service was 14.1%. Ten occurred in patients delivered operatively, an incidence of 11.4%. Two of the gravidas with precipitate labor (4.4%) had cervical lacerations. Two or 6.6% of the patients whose second stage of labor had been completed within five minutes had cervical lacerations.

Postpartum Hemorrhage

There were eleven postpartum hemorrhages on the university service, an incidence of 6.4%. In seven patients the blood loss was between 500 and 1000 ml. One patient lost more than 1000 ml. of blood. In three the volume lost was unknown. One hemorrhage occurred after a failed induction, with several oxytocin infusions and stripping of the membranes. Three occurred in women who had been induced with oxytocin either alone or as the successful part of a multiple try induction. Four more were associated with the use of oxytocin to stimulate induced

labors. Two postpartum hemorrhages were associated with stripping of the membranes for induction. In one of these two patients stripping had been combined with sparteine. One hemorrhage was associated with induction with sparteine alone. Thus, seven or 63.6% of the postpartum hemorrhages on the university service were associated with the use of oxytocin. Seventy-one women on the university service had received oxytocin either as part of induction or stimulation of labor. The incidence of hemorrhage among these women was 9.9%. In three of these eleven postpartum hemorrhages there were cervical lacerations. Six gravidas who developed postpartum hemorrhages had been administered intravenous oxytocin. Fifty-four women on the university service had received oxytocin intravenously postpartum.

Postpartum hemorrhage was slightly more frequent among the women electively induced than among women whose labors began spontaneously on the university service. Its incidence among the ward population for the two year period was 6.1%. This is markedly lower than the incidence of hemorrhage among the induced patients who received oxytocin.

Puerperal Morbidity

On the university service there were thirty-five women whose temperatures rose above 100.4°F. for at least one day of the puerperium, an incidence of 20.2%. Twenty-four gravidas had temperature elevations for only one day. Eleven exhibited standard puerperal morbidity (6.4%). None had a fever for more than four days. One patient (#0191) whose temperature was elevated for four days was a nullipara whose induction with stripping of the membranes failed. Her labor began spontaneously about thirty-six hours after the stripping and was prolonged. After twenty hours of labor she became febrile and four hours later underwent cesarean section when marked fetal bradycardia was noted. At section, culture of the lochia was taken and grew out A. aerogenes. She was treated with streptomycin and achromycin, but remained febrile through the fifth postpartum day. Two of the three gravidas who were febrile for three days had urinary tract infections. The third patient, (#1338), became febrile on the second postpartum day. Urinalysis revealed 10-12 WBC. Her breasts were full and she was given one ampule of Pitocin on the assumption that her temperature was due to breast engorgement. On the third day of the puerperium she became afebrile and was discharged the next day. She

returned to the Emergency Room that evening with a temperature of 102°F. Urine culture at that time was three plus for E. coli. Lochia culture from her hospital stay was reported also as three plus for E. coli. She was treated with streptomycin and achromycin and was not seen again. All three women had had their membranes stripped. One had received sparteine in conjunction with stripping, another had received sparteine more than twenty-four hours after stripping. The etiology of five of the seven two day fevers was established. One woman had endometritis proven by culture, three suffered from urinary tract infections, and one had an upper respiratory tract infection.

The twenty-four one day fevers were attributed in four cases to endometritis, in three to urinary tract infections, in two instances to a combination of urinary tract and pelvic infections, in four cases to breast engorgement, and in one patient to an upper respiratory tract infection. The etiology of ten one day fevers was not established. All but one of the cases with endometritis was treated with antibiotics. She had had a positive placental culture only. Two gravidas whose labors were stimulated with amniotomy were febrile for two days. One of these two women developed endometritis. Four patients whose labors were stimulated with amniotomy developed one

day fevers. One patient with a one day fever was induced with amniotomy and responded with labor after a latent period of two and one half hours. Nineteen of the twenty-four women febrile for one day were induced totally or in part with stripping of the membranes. Four of these nineteen had failed inductions with stripping. Nine had latent periods of over six hours. Two had been stripped a second time, one with a latent period of less than one hour, the other with supplementation by oxytocin after a latent period of between three and four hours. The eleven women with standard puerperal morbidity included nine women in whom stripping of the membranes had been used for induction. Three of them had had failed strippings and three others had latent periods over six hours.

In addition to the women who became febrile, there were seven patients with positive cervical or lochial cultures, four of whom received no antibiotic therapy, three women with urinary tract infections, two of whom received no treatment, and two women with thrombophlebitis. If one considers all fevers over 100.4° F. of unknown origin in the postpartum period to be pelvic[76] and adds the twelve of these to the twelve cases in which positive cervical or lochial cultures were obtained and treatment either given or the temperature became elevated, there are twenty-four

women with pelvic infection, an incidence of 16.2%. There are twenty-one women with pelvic infection severe enough to cause one day temperature elevation (12.1%) and fifteen with pelvic infection severe enough to cause standard puerperal morbidity (8.7%).

PERINATAL MORTALITY

There were no perinatal deaths on the general service. There were no intrapartum deaths on the university service. There was one neonatal death. This occurred in an erythroblastotic infant born of an Rh positive woman (#0027) with unsuspected ABO sensitization. The infant received an exchange transfusion, but died on the second day of life. Gross perinatal mortality for the university service was 5.8 deaths per 1000 live births and for the entire series 1.4 deaths per 1000 live births. Corrected perinatal mortality was zero.

FETAL COMPLICATIONS---GENERAL SERVICE

Prolapsed Cord

There were no prolapsed cords on the university service. There was one prolapsed cord on the general service, the incidence of prolapse being 0.19%. This occurred in a breech presentation. The patient, #1170, a gravida ii, was induced with a soft, effaced, three centimeter dilated cervix with the breech at zero station. She was given an oxytocin infusion which ran for slightly over three hours and was discontinued at full dilation. At this point the membranes ruptured spontaneously and prolapse of the cord occurred. The Apgar score was between four and six at one minute, but above seven at five minutes.

Fetal Distress

Twenty-two women or 4.1% of the patients delivered on the general service exhibited one or more signs of fetal distress before six centimeters dilatation was attained. There were two patients in whom both fetal bradycardia and meconium staining were noted. Both (#0578 and #1009)

were delivered by cesarean section. One had been induced with amniotomy and stimulated with oxytocin (#0578), the other had been induced with sparteine (#1009). Isolated meconium staining in a vertex was noted at induction with amniotomy and oxytocin once. Three patients were noted to have fetal bradycardia. One of these three was delivered of a depressed infant, while a second exhibited bradycardia again during the second stage of labor.

The great bulk of the patients with signs of fetal distress in this early part of labor, sixteen of the twenty-two, exhibited fetal tachycardia only. Fetal tachycardia was associated nine times with precipitate labor and twelve times with the use of oxytocin for induction.

Fetal distress was less common at or past six centimeters dilatation, being noted in only seven patients (1.5%). The proportion of labors terminated by section after fetal distress had been noted was increased, two of seven. There were three gravidas during whose late first stage fetal tachycardia was noted. One of these three patients' labors was terminated by cesarean section because of failure of the head to engage after thirteen and one half hours of labor (#1294). The other two episodes were not associated with subsequent fetal distress

or neonatal depression. There was one isolated episode of meconium staining in a woman whose labor was spontaneous, an attempt at induction with oxytocin having failed. There were three episodes of fetal bradycardia. One occurred in a woman induced with sparteine when, at seven centimeters dilatation, she was stimulated with oxytocin. She was subsequently delivered by cesarean section. Her case has been discussed previously (#1342). The other two episodes were also related to stimulation with oxytocin.

During the second stage of labor there were eighteen women who exhibited signs of fetal distress (3.4%). In fifteen instances the only sign of fetal distress was bradycardia. This was associated once with a second stage shorter than six minutes and four times with a second stage of thirty to sixty minutes. In three instances bradycardia during the second stage was followed by neonatal depression at one minute. In no case was this a lasting depression. There were two patients in whom meconium staining was noted during the second stage of labor. Marked neonatal depression was present in one of these two at birth. Meconium passage and bradycardia occurred in one general service patient prior to delivery. The infant was born with the cord wound tightly around its

neck after a fifty-seven minute second stage terminated with midforceps. The Apgar score was depressed at one, but not five minutes.

Fetal distress was most common during the early part of the first stage and during the second stage of labor on the general service. However, a substantial proportion of the women in whom early fetal distress was noted exhibited evanescent tachycardia only. Fetal bradycardia was manifest in sixteen of the eighteen patients in whom second stage distress was noted. Fetal tachycardia was not noted during the second stage. Bradycardia and meconium passage were noted three times on the general service and both infants in whom this was noted before full dilation were delivered by cesarean section. Two other cesarean sections were performed on patients who exhibited other signs of first stage fetal distress.

Apgar Scores

Five hundred thirteen live births on the general service had one minute Apgar scores of seven or more. Twenty-two-infants had depressed Apgar scores at one minute (4.1%). Three of these neonates had depressed scores at five minutes as well. One other infant, whose score had been above seven at one minute, had a score of

between four and six at five, bringing the incidence of depressed Apgars at five minutes to 0.74%. Seven of the neonates with depressed scores had exhibited earlier signs of fetal distress and two of them were prematures. In four cases labor had been precipitate. Three infants, including one delivered by cesarean section (#0578), were the product of labors lasting more than twelve hours. One depressed infant was associated with a labor in which a tetanic contraction occurred (#1245). Twenty-one of twenty-three depressed neonates were delivered following labors in which oxytocin had been used for induction or stimulation. In one of these twenty-one cases the induction had failed and labor had been spontaneous. Ten depressed babies were the product of labors in which amniotomy had been performed. In three instances sparteine had been used for induction. All of the infants with depressed scores survived.

Premature Births

There were twenty-one premature infants among 543 live births on the general service, an incidence of 3.86%. The comparable figures for the general service as a whole for the same two year period was 449 prematures among 7710 live births, or a frequency of 5.8%. Four infants

were delivered who weighed less than 2000 grams. One was delivered by cesarean section. The case has been described previously (#0079). The other three were twins and weighed 1845, 1855 and 1975 grams at birth. There were seventeen infants who weighed between 2000 and 2500 grams at birth. Six of these were twins. Two of the remaining eleven had been induced with amniotomy. Nine had been medically induced. All twenty-one prematures survived.

FETAL COMPLICATIONS---UNIVERSITY SERVICE

Fetal Distress

Early fetal distress was detected in seventeen patients on the unversity service, the incidence being 9.8%. Seven gravidas were noted to have fetal tachycardia. In one instance tachycardia was combined with meconium passage. The fetus was a breech presentation. Four patients were observed to have fetal bradycardia, and isolated meconium staining was observed in five. There was one labor in which marked irregularity of the fetal heart rate was recorded.

Fetal tachycardia was associated once with uterine spasm (#0500), once with second stage bradycardia, once with second stage tachycardia, and once with depression at birth. A fifth patient, #0089, with early fetal tachycardia was delivered by cesarean section because of uterine inertia and intrapartum fever. All six gravidas in whom early fetal tachycardia was noted received oxytocin for induction or stimulation.

There were four labors in which early fetal bradycardia was noted. Three of these labors had been induced with oxytocin, the fourth with stripping of the membranes. In no instance was the bradycardia prolonged or associated with neonatal depression. Marked irregularity of the fetal heart rate was noted in one labor. This patient's membranes had been stripped, but, before labor ensued, she had received two courses of sparteine at five hour intervals and an oxytocin infusion (#0014). Bradycardia and meconium staining were noted during the second stage, but the infant was not depressed at birth.

Four of the five patients in whom early meconium staining was noted had received oxytocin. Meconium staining during the early first stage was associated once with marked fetal depression at birth, though there had been no intervening signs of fetal distress. Seven

discrete efforts had been made to induce this particular gravida. Four of these had been elective and three had been indicated because of the lapse of time following premature spontaneous rupture of the membranes. Ultimately she was induced with a combination of oxytocin intravenously and sparteine intramuscularly. Her case has been noted previously (#1337). Early meconium staining was noted during the labor of a nullipara who was induced with oxytocin and subsequent amniotomy. The first stage of her labor lasted less than two hours, the second stage, between one and two hours. The infant's Apgar score was below seven at one minute, but above seven at five minutes. One episode of early meconium staining was associated with bradycardia during the second half of the first stage. Labor was terminated after twenty-four hours by cesarean section (#0191). At section, the umbilical cord was found trapped between the occiput and the brim of the pelvis. Labor had been spontaneous in onset, stripping having failed to induce it.

There were two instances each of fetal bradycardia and fetal tachycardia in the second half of the first stage on the university service,making the incidence of signs of fetal distress at this point 2.3%. In one of the two cases of fetal tachycardia, the elevated fetal

heart rate persisted through the early part of the second stage. The latter lasted nearly four hours. At delivery there was a true knot in the umbilical cord. The latter was wound tightly about the infant's neck. This case, in which induction was achieved with sparteine, has been noted earlier (#1184). The infant's Apgar score was below four at one minute, but above seven at five minutes. One of the two cases of fetal bradycardia at six centimeters dilatation has already been described. The second episode of bradycardia was associated with bradycardia during the second stage as well. Delivery was operative; Apgar scores were not noted. Induction had been achieved with an oxytocin infusion discontinued at three centimeters dilatation.

There were fourteen university cases of fetal distress during the second stage of labor (8.1%). In seven of these bradycardia was the sole sign of distress. Three cases of bradycardia, one associated with bradycardia during the latter part of the first stage, one associated with tachycardia during the early part of the first stage, and one associated with meconium during the early part of the first stage, have been noted. All seven infants with second stage bradycardia were delivered with forceps. The second stage lasted less than six minutes

in two of these patients and between six and thirty minutes in four. In four cases oxytocin had been used for either induction or stimulation. In four stripping of the membranes constituted all or part of the induction procedure. Sparteine had been used in two. Only in the case where early meconium staining had occurred was there any neonatal depression following second stage bradycardia.

There were three instances of second stage meconium staining coupled with bradycardia. One, associated with early irregularity of the fetal heart rate, has been described. There were two cases in which meconium and bradycardia were associated with subsequent neonatal depression. One woman had been induced with the second of two strippings of the membranes, the first having failed. The second stage was precipitate. Apgar score at one minute was below four and at five minutes was between four and six. The other woman's labor was spontaneous, stripping having failed to induce her. The infant was delivered with "low mid forceps". Its Apgar score was between four and six at one minute, but above seven at five minutes.

There were two instances of second stage tachycardia, both of which have been described. There were two cases of isolated meconium passage during the second stage.

One patient had been induced with oxytocin, one with digital stripping of the membranes. One of these infants had a one minute Apgar score of between four and six.

On the university service, just as on the general service, fetal distress was most common at the start of labor and during the second stage. Bradycardia was seen most often during the second stage of labor. One cesarean section was performed in a patient (#0191) in whom first meconium passage and then bradycardia were noted. There were three other patients in whom bradycardia and meconium passage were noted, but these three all occurred during the second stage. The overall incidence of this sign was 2.3% on the university service.

Apgar Scores

On the university service 156 of 175 live births had Apgar scores of seven or better at one minute. Two scores were not noted. Seventeen infants (9.71%) had depressed scores. Four of the seventeen had depressed scores at five minutes as well (2.3%). Eight of the seventeen depressed neonates had shown signs of fetal distress during labor. One was premature, one a breech. One had been delivered by cesarean section (#0091).

Ten infant's mothers had been induced or stimulated with oxytocin. Four labors had been successfully and four unsuccessfully induced by stripping of the membranes. Amniotomy had been used in three instances. Sparteine had been employed in three labors. Labor had been prolonged over nine hours in three instances. The second stage of labor lasted over one hour in two patients. Labor was precipitate in one. None of the infants with depressed scores died.

Premature Births

There were eleven premature infants among 175 live births delivered on the university service, an incidence of 6.3%. The comparable figures for the entire university service for the same two year period were 336 prematures and 2586 live births, an incidence of 13.0%. Three of four twins were premature, one weighing less than 2000 grams. One of the remaining eight prematures was the product of a labor in which, two oxytocin infusions having failed, induction was accomplished with amniotomy. One premature (#0191) was delivered by cesarean section. Amniotomy played no role in the induction of the other six. All did well. None died.

DURATION OF GESTATION---BOTH SERVICES

In 234 patients on the general service the duration of gestation was recorded. Five of these 234 women were induced between thirty-four and thirty-seven weeks of gestation. Forty-nine were induced between thirty-seven and thirty-nine weeks, 142 were induced between thirty-nine and forty-one weeks, and thirty-five were induced between forty-one and forty-two weeks. In three patients the length of gestation was unknown.

Similar information was obtained about eighty-one women on the university service. Two were induced before thirty-seven weeks. Thirteen were induced between thirty-seven and thirty-nine weeks. Forty-three underwent induction between thirty-nine and forty-one weeks. Eighteen were induced between forty-one and forty-two weeks.

DISCUSSION

Elective induction of labor, performed on two separate groups of patients at the Grace-New Haven Community Hospital over a two year period, resulted in the birth of 718 live infants. There were no maternal deaths or uterine ruptures in either group and only one neonatal death. The latter was not related to induction.

LATENT PERIOD AND LABOR AFTER SURGICAL AND MEDICAL INDUCTION

The incidence of prolonged latent periods following induction, of failed induction, and of precipitate labor differed considerably in the two groups. There was some difference in the distribution of women with widely and less widely dilated cervices on the two services, but this difference was scarcely sufficient to account for the differences in the length of the latent period and labor. Though there were proportionately more women with cervices two centimeters dilated on the university service, this service had correspondingly fewer patients whose cervices were either less than two centimeters or more than three centimeters dilated. There were nearly fifty percent more

nulliparas on the university service. However, proportionately three times as many patients had latent periods of less than one hour on the general service when the initial attempt at induction was made. Over twice as many had latent periods of four hours or less on the general service, while the incidence of failure of the initial induction effort was more than three times as high on the university service.

Numerous authors have established criteria for favorability for induction[4,6,22,26,29,33,34,65,73]. These criteria, with the exception of parity, seem to be met by roughly equal proportions of both groups. The two groups differ markedly in the choice of methods for induction, far more markedly than they do in terms of the frequency with which nulliparas were induced. Stripping of the membranes was performed initially in 67.1% of the general service inductions. Amniotomy was used alone first in 28.7% of the general service cases and in combination in an additional 13.4%. On the university service it was used in only 2.3% and 1.7% respectively. Oxytocin was used alone in 40.1% of the general service patients and in combination in an additional 11.4%, while on the university service it was used in 17.3% and 1.7% respectively. Sparteine was used in 12.7% by itself and in 2.4% as a part of a combined

measure on the general service, but in only 6.4% and 0.6% of the university patients. Combined measures accounted for 26.5% of the general service inductions but only 3.5% of the university ones.

Amniotomy was the single most effective means of inducing labor. Used either discretely or in combination, it succeeded in producing labor in all but one of 258 women (247 general plus eleven university service patients). Moreover, 138 of the 177 (78%) patients induced with discrete amniotomy were in labor in two hours. Adding sparteine or oxytocin to amniotomy shortened the latent period still further. All but one of the eighty gravidas in whom this combination was used were in labor within two hours. The proportion of labors less than three hours in duration was about the same, 66.9% for amniotomy on both services, 68.2% for amniotomy and oxytocin, and 61.5% of thirteen women who were induced with amniotomy and sparteine.

Stripping of the membranes was the least effective method. On the university service it failed to produce labor in slightly over one third of the patients in whom it was used (35.9%). On the general service its record was slightly better (31.3% failed inductions). On the university service an additional 19.1% had latent periods of more than eight hours. Only 10.7% of 131 university

patients had latent periods of two hours or less. Ten of the seventy labors stripping induced lasted over twelve hours, sixteen were precipitate. On the general service there were only fifteen labors directly attributable to stripping of the membranes, one of which lasted more than twelve hours and two of which were precipitate.

Oxytocin failed to induce labor 24.3% of the time and 15.8% of the time on the university and general services respectively. It produced labor within two hours of its use in 67.9% and 43.2% of the gravidas on the two respective services. Forty-three and six tenths percent of the labors on the general service and 27.5% of the university service labors for which oxytocin was responsible were precipitate. One possible explanation for the discrepancy between the results obtained with the use of oxytocin on the two services is that oxytocin was used on the general service only 18.9% of the time in patients wholly or partially refractory to previous inductive attempts, while 59.5% of its use on the university service occurred under these circumstances.

Sparteine was used far less frequently than the other three measures. It produced labor within two hours of its use in 57.1% of the general and 58.1% of the university patients. It failed to induce 14.3% of the general and

12.9% of the university service gravidas to whom it was given. It produced labors of three hours or less in 37.3% and 30.0% of the labors it successfully induced on the two services.

The discrepancy between the results of induction on the two services appears to be related to the discrepancy between the methods used for induction. The increased use of stripping of the membranes on the university service, with its relatively poor results, tended to skew the results of induction in one direction, while the disproportionately frequent use of amniotomy on the general service skewed the results on this service in the opposite direction.

Amniotomy is most efficient from the point of view of putting the patient into labor and producing relatively short labors. Combining it with oxytocin seems to shorten the latent period, without significantly increasing the incidence of precipitate labor. Amniotomy combined with oxytocin is far more effective than oxytocin alone. Stripping of the membranes is the most inefficient of the modes of induction used in this series.

The hazards imputed to amniotomy include prolapse of the cord, displacement of the presenting part with resultant malposition, prolonged latent period with resultant infection[28], increased incidence of neonatal respiratory distress, and prematurity[55].

Malpresentations

There were five malpresentations in this series, a face presentation, a transverse lie, two compound presentations, and one suspected compound presentation. None occurred in patients induced with amniotomy. The one transverse lie was the only malposition which developed subsequent to induction. This patient had failed to respond to an oxytocin infusion. There was only one cord prolapse in the entire series. This occurred in a breech presentation following spontaneous rupture of the membranes at full dilatation. It was totally unrelated to amniotomy. All but one breech on the university service had been recognized as such at induction. Though they were not direct complications of induction in this series, malpresentation and prolapse of the cord do complicate induction in other series. Keettel[48] reported an incidence of 0.39%

of the former and 0.32% of the latter. Perinatal mortality occurred in 29.6% of his patients with malpresentation and 45.5% with prolapsed cords. The hazard is quite real.

Keettel[48] and Niswander[54,55] and Bishop[5] oppose induction of breech presentations. Stone[76] and Hukill[42] do not consider breech presentation to be a contraindication to induction with an oxytocin drip. Four presumed breeches were induced on the university service. One of the presumed breeches was later determined to be a floating vertex presentation. The only breech presentation not detected at induction was delivered on the university service after a spontaneous labor, stripping of the membranes having failed to induce the patient. There were eight known breeches on the general service at induction. This included two twins "A". No gravida with a breech presentation was induced with amniotomy. Intravenous oxytocin or intramuscular sparteine was used to induce eight of the total of twelve breeches. Stripping of the membranes was employed in the other four. Mild neonatal depression occurred in two of the four breeches delivered on the univeristy service and three of the eight on the general service. Two breeches, one on each service, exhibited fetal tachycardia during the first stage of labor. In one, frank prolapse of the umbilical cord occurred during the second stage.

Willson[75] considers infection one of the major hazards of elective induction. Keettel[48] has demonstrated an association between a prolonged latent period following amniotomy and intrapartum and postpartum fever. The only postpartum fever associated with a prolonged latent period on the general service was a one day fever in a patient with an infected episiotomy. Only one of seven cases of presumed pelvic infection occurred in 247 women induced with amniotomy on the general service, an incidence of 0.4%, while six occurred among 263 women induced by medical means only, an incidence of 2.3%. Two of these six were related to premature rupture of the membranes and cesarean section. The comparable incidence of endometritis on the general service for the same two year period was 0.22%. The increased incidence of pelvic infection in the medically induced group might be explained on the basis of the higher incidence of vaginal examinations.

On the university service there were twenty-four cases of presumed pelvic infection. Eighteen of these were associated with stripping of the membranes. Of the 119 women in whom stripping of the membranes formed part of the induction procedure, 15.1% developed either pelvic infection, proven by culture and warranting the use of antibiotics, or a postpartum fever of unknown etiology. All but three

of these eighteen patients had latent periods of over six hours or failed inductions. Four of these eighteen women had spontaneous prematurely ruptured membranes, two of them for more than twenty-four hours before induction was achieved. However, the incidence of pelvic infection among the forty-five women induced solely by medical means was 13.3%. Only two of these gravidas had spontaneous prematurely ruptured membranes.

The incidence of pelvic infection on the entire university service for the same period was 2.8%. It is tempting to attribute the increased incidence of pelvic infection among the induced patients to the frequency of prolonged latent periods following digital stripping of the membranes. The high incidence of infection among the medically induced, however, does not lend credence to this idea. There does not seem to be any definite explanation for this increase in incidence of pelvic infection. One might postulate that it is related to an increased number of vaginal examinations in women who are electively induced, but this has not been evaluated in this paper.

Neonatal Depression

It has been argued by some authors that neonatal respi-

ratory distress is more common among infants born of induced labors[55,68,73]. Hendricks[1] disagrees with this. Tucker and colleagues[74] have reported that precipitate labor (defined as lasting no longer than two hours) appears to predispose to respiratory difficulty during the early neonatal period. The incidence of hyaline membrane disease, atelectasis, pneumonia, and other causes of neonatal respiratory distress among the children of induced labors has not been evaluated in this series. However, the Apgar scores of all the neonates in whom they were recorded have been noted. D'Esopo[14] reported a disquieting increase in the number of infants with depressed Apgar scores (below six) in 1,000 labors, nearly all of which were induced with oxytocin and subsequently amniotomy. He related this increase to the shortness of the labors of patients who were electively induced. In the present series the incidence of infants with depressed Apgar scores at one minute and five minutes was 4.1% and 0.74% on the general service and 9.7% and 2.3% on the university service. Only four depressed infants were the product of precipitate labors on the general service, while three were born after labors of more than twelve hours. Similarly, there was little association between precipitate labor and neonatal depression on the university service where precipitate labor was far less

common. Neonatal depression did seem to be more common among infants born of labors in which oxytocin was used. It was less frequent when amniotomy had been performed. This seems to substantiate Tafeen's[73] impression that neonatal apnea is less frequent when the membranes have been ruptured artificially.

Premature Births

The delivery of premature infants has been considered one of the great hazards of elective induction of labor[1,48,54,55,72]. Almost all authors on the subject of elective induction consider suspicion of prematurity, premised on either history or physical findings, to be a contraindication to induction. This is quite understandable in view of the increased perinatal mortality among the premature. It has been suggested by Stone[1] and by Niswander[54] that the danger of delivery of a markedly premature infant is reduced when only medical methods of induction are used. This is based on the contention that the unripe uterus will not respond to oxytocin. This same virtue has been claimed for sparteine[57]. It is noteworthy in this series that the only infant weighing less than 2000 grams and born of a single pregnancy, was delivered by cesarean section

after several oxytocin infusions had failed to produce labor (#0079) at thirty-four weeks.

The incidence of premature births is considerably reduced in the electively induced population from the incidence in the total obstetrical population. This reflects an apparent effort on the part of the physicians involved to select only women with mature infants for elective induction. Twelve of thirty-two prematures delivered were twins. Twelve of eighteen twins delivered were premature. It has been contended by several authors[48,55] that women with multiple pregnancies ought not to be electively induced because of the increased difficulty of evaluating fetal size. The results of this series confirm this difficulty. It is noteworthy that all but one set of twins were recognized at induction. Though none of the twins were depressed at birth and there were no perinatal deaths among them in this series, the high incidence of prematurity must be considered to militate against elective induction of known multiple pregnancies. Non-indicated induction of women likely to deliver premature infants is subjecting the newborn to unwarranted hazards. The lack of untoward results among the thirty-two prematures delivered in this series does not warrant the conclusion that such inductions are not without considerable danger.

The hazards imputed to the use of oxytocin for induction include uterine rupture, uterine spasm, postpartum hemorrhage, laceration of the cervix and birth canal, and tumultous labor with increased danger to the fetus from anoxia and trauma[28].

Tetanic Contractions

There were no cases of uterine rupture in this series and only four cases of uterine spasm. Three of these were clearly associated with the intravenous use of oxytocin and one with the intramuscular use of sparteine. One tetanic contraction was associated with fetal tachycardia and one with neonatal depression. There were no apparent lasting ill effects and in no case was there any recurrence of uterine spasm. One woman was delivered abdominally, but not because of the tetanic contraction. The infrequent occurrence of uterine spasm may be related to the care and low dosage with which oxytocin is administered at this hospital. Sparteine, because of its association with tetanic contractions at this hospital and in various reports in the literature, not discussed herein, is no longer used on the university service prior to delivery and has been abandoned all but totally on the general service.

Cervical Lacerations

There were thirty-six major lacerations on the general service. Ten of these involved the cervix. Seventeen of the major lacerations occurred following successful induction with oxytocin, as did all but two of the cervical lacerations. The incidence of cervical lacerations was 33.3% higher among women who had received oxytocin (2.4%) than in the electively induced population as a whole. Cervical tears requiring repair occurred in only 1.4% of the patients whose membranes had been ruptured artificially for stimulation or induction. On all the occasions in which laceration occured following amniotomy, oxytocin had been used also. Vaginal lacerations were associated frequently with the use of oxytocin. Seven of twelve third and fourth degree lacerations were associated with precipitate labor, as were ten of twenty-one lacerations involving the vagina. Only two of ten cervical lacerations followed precipitous labors.

There were eighteen major lacerations on the university service. Vaginal and cervical lacerations accounted for all but one of these. Cervical lacerations were again associated preponderantly with the use of oxytocin, and only infrequently with precipitate labor (two of eleven).

This lack of association is not quite so striking since precipitate labor was far less common on the university service. Only three of eight lacerations involving the vagina occurred in relation to precipitate labor. The incidence of vaginal and cervical lacerations among the university parturients with precipitate labor were 6.7% and 4.4% respectively. Among gravidas without precipitate labor the incidence of the two events was 4.0% and 6.4%.

Lacerations of the vagina and major perineal lacerations seem related closely to precipitate labor. Lacerations of the cervix, while related to the use of oxytocin, are not related so closely to precipitate labor. The relationship between cervical laceration and oxytocin is predicated in the literature on production of precipitate and tumultous labor by the latter. The resultant labor is presumed to lead to overly rapid cervical dilatation, rapid delivery and cervical laceration. Cervical lacerations have been reported to occur in as many as 42% of parturients receiving oxytocin[58].

The curious association in this series of cervical lacerations with oxytocin, but not with precipitate labor, prompted further evaluation of the circumstances of these lacerations. In nine instances the oxytocin infusion used

had been continued to full dilatation. Three of the twenty-one cervical lacerations on both services occurred in spontaneous deliveries. Two occurred after precipitate deliveries with second stages of less than six minutes duration. Therefore, there was not much of an association with these factors. Nine occurred in gravidas whose second stage lasted more than thirty minutes. Five of these long second stages had lasted over one hour. Therefore, 8% of the parturients with lengthy second stages had cervical lacerations and 25% of the twenty gravidas with second stages of over one hour in length suffered laceration of the cervix at delivery. Laceration of the cervix in this series seems to be related more to difficult operative deliveries following a prolonged second stage than to any other specific factor. Trauma to the cervix appears to be mediated more often by forceps than by induction. This is in conformity with Hukill's[42] impression of the relationship between cervical laceration and induction of labor.

Postpartum Hemorrhage

The incidence of postpartum hemorrhage was elevated on both general and university services when elective induction of labor was performed. It was still more elevated

among electively induced patients who had received oxytocin, despite the use of intravenous oxytocin after labor in one third of the general and three fourths of the university parturients in this category.

Fetal Distress

Signs of fetal distress were most common during the early part of the first stage of labor on both services. A substantial proportion of this early fetal distress was manifested by fetal tachycardia only. Ginsberg[31] has stated that increase in the fetal heart rate to levels of over 170 beats per minute does not signify severe fetal distress, while Fields[27] has noted that transient alterations in fetal heart rate are often detected in normal labors and prove to be of little significance. In all but three instances in this series, fetal tachycardia occurring early in labor appeared to be entirely benign. In these three, subsequent fetal distress or neonatal depression was noted. Ginsberg attaches more significance to fetal tachycardia when coupled with meconium staining in a vertex presentation. This complication did not present itself in this series. Isolated meconium staining in a vertex presentation is not usually indicative of a among [illegible]

length, [illegible]

[illegible]

[illegible]

[illegible]

Signs of [illegible]

early part of [illegible]

A substantial [illegible]

manifested as [illegible]

stated that [illegible]

[illegible]

distress, while [illegible]

tions in fetal [illegible]

nature and [illegible]

but rather [illegible]

[illegible]

poor prognosis for the fetus, but it does indicate a need for close observation on the part of the attending physician as it may be a harbinger of other more serious signs of distress[31]. Meconium passage during the early part of labor led to one cesarean section on the university service when it was succeeded by fetal bradycardia later in the first stage. Fetal bradycardia during the early part of the first stage, less common than early tachycardia, was associated two of six times with subsequent fetal distress or neonatal depression. Fetal bradycardia, particularly when associated with passage of meconium in a vertex, is considered by most authorities to be an indication of possible grave danger to the fetus. Two such occurrences in the early part of the first stage led to cesarean section on the general service.

Fetal distress during the late first stage was considerably less common than early fetal distress. Generally, the signs of fetal distress noted during this part of labor were fetal tachycardia or fetal bradycardia. Two cesarean sections on the general service and one on the university service, noted above, were performed on the seven and four women on the two respective services in whom late first stage fetal distress was observed.

Fetal distress during the second stage of labor was

nearly as common on both services as was early fetal distress. The sign of fetal distress reported most frequently at this point was fetal bradycardia. Three of the ten fetuses exhibiting bradycardia during the second stage on the university service, and one of the sixteen on the general service, passed meconium, also. Three of these four infants were depressed at birth. Neonatal depression was far more frequent following deliveries in which second stage distress had been observed than in those deliveries in which signs of fetal distress had been noted earlier. Nineteen of the thirty-one individual gravidas on the university service in whom fetal distress was noted had received oxytocin infusions. Thirty-seven of the forty-four women on the general service whose labors were characterized by one or more signs of fetal distress had been administered oxytocin. The frequency with which oxytocin was associated with fetal distress is considerably in excess of the frequency with which oxytocin had been used.

It has been postulated that fetal distress is more common among women who have received oxytocin because the latter may produce uterine spasm or rapid and tumultous labors. The frequency and strength of contractions in such labors, coupled with inadequate inter-contraction uterine relaxation, may severely impede plancental blood flow and cause fetal anoxia. In addition, by forcing the fetal head

against an incompletely dilated cervix or against unyielding soft and bony parts of the mother's perimeum and pelvis, such contractions may cause cranial compression or intracranial hemorrhage and produce signs of fetal distress in either of these two manners.

Fetal tachycardia was related in one instance to a tetanic uterine contraction. Five of the university patients exhibiting fetal distress during labor had first stages of three hours or less in duration. Twenty-three of the forty-four general service patients who exhibited fetal distress had first stages of similar length. The incidence of labors with short first stages among the women exhibiting signs of fetal distress was not significantly different from the incidence of such labors among all the patients who were electively induced.

STATUS OF THE CERVIX AT INDUCTION OF LABOR

The degree of effacement and the extent of cervical dilatation which different authors suggest is necessary before elective induction can be safely and advantageously performed has been discussed earlier in this paper. Particu-

lar attention was paid in the present paper to the relationship between dilatation of the cervix at induction and the length of both latent period and labor. Both were shorter when the cervix was more widely dilated. The results of the present series would indicate that the best prophylaxis against a delayed labor after induction is not to induce patients with cervices less than three centimeters dilated. Similarly the most accurate guarantee of a short labor is a cervix three centimeters or more dilated before its start. Provided the technique of induction is not stripping of the membranes, these statements appear to be consistently true.

INDUCTION OF NULLUPARAS

The discussion in the literature about the advisability of inducing nulliparous women electively has been cited. In the present series it is to be noted that prolonged labor and cervical lacerations (eleven of the twenty-one such lacerations on both services occurred in nulliparous patients) were far more common among nulliparas. Eleven and one-tenth percent of nulliparas, but only 9.0% of multiparas, on the general service had failed initial

induction attempts. Thirty and eight-tenths percent of nulliparas and 29.1% of the multiparas on the university service had failed initial induction attempts. Postpartum hemorrhage was more frequent among nulliparous patients on the university service, but more common among multiparous women on the general service. Standard puerperal morbidity was markedly more frequent among the nulliparas on both services (2.5% vs 0.4% and 12.8% vs 6.7%). Nulliparous patients were less likely to respond to elective induction with short, comfortable labors than multiparas. They were more likely to have complicated labors, deliveries and puerperiums. There seems to be little justification for elective induction of nulliparas unless the circumstances in which an induction is to be performed are most unusual.

PRECIPITATE LABOR

Precipitate labor was the most frequent complication encountered in this series. The dangers of precipitate labor have been noted previously to include interference with placental circulation and oxygenation of the fetal blood because of frequent tumultous contractions with little

relaxation between them, cerebral trauma as the result of overly forceful thrust of the fetal presenting part against the bony pelvis, maternal trauma as a result of rapid transit of the fetus through the birth canal, and, perhaps, most important, precipitous and often unattended delivery[65]. Benaron and Tucker[2,74] and their co-workers have noted a small increase in immediate neonatal depression after precipitate labor[74]. In a small series of forty-five patients they correlated precipitate labor with subsequent mental retardation and poorly developed laterality in the use of hands, eyes and feet[2]. They conjectured that these children had suffered cerebral damage as the result of precipitous labor. Such damage could have been sustained as the result of trauma or anoxia. However, Tucker and Benaron admit their series is small and that no far-reaching conclusions can be based on it. Their paper is prefaced with an explanation of the obstetrical service of the Chicago Maternity Clinic from which their patients were selected. On this service 16.7% of the deliveries are unattended and all are home deliveries. The percentage of the forty-five children studied in which labor and delivery had been unattended is not specifically stated. Despite the increased incidence of precipitate labor among electively induced patients, Tucker and Benaron's papers might well be used as arguments for elective induction.

One of the advantages of such induction is the prophylaxis of unattended precipitate labors and deliveries.

Karlovsky and Thoms[45], the former head of the Yale Department of Obstetrics, took a less pessimistic view of precipitate labor. Reviewing 129 cases, they concluded that in 80% of the patients "well supervised (and) intelligently conducted, precipitate labor is an ideal labor for the mother and without increased danger for the infant". In the other 20%, strong and frequent uterine contractions occurred. These conceivably were capable of impairing fetal oxygenation or causing intracranial trauma during descent. Thoms and Karlovsky considered decreased resistance of the cervix and soft parts an important factor in the etiology of precipitate labor. They reported an incidence of precipitate labor at this hospital of 12.9%.

Conger and Randall[12] state that both mother and baby react favorably to precipitate labor. In some respects, they contend, precipitate labor is more desirable than parturition of the average length. They distinguish between precipitate labor and precipitate delivery and conclude that the former is not truly a complication of labor, but a relatively benign variation from the normal pattern. Conger and Randall included parity, a normal pelvis, an occiput anterior presentation, and a previous history of

rapid labor among the factors predisposing to precipitate labor. Forty percent of their patients had a past history of rapid labor. Conger and Randall noted an increased incidence of precipitate labor among the induced population.

It has been noted in numerous papers that women who are induced tend to have shorter labors. Indeed, this is claimed to be one of the advantages of the elective induction of labor. Schaeffer[65] noted that the incidence of precipitate labor, while only 10% in a set of controls, was 66% in a group of 277 private patients with cervices three centimeters dilated and vertex presentations at station minus one or lower at the time of elective induction of labor. Guttmacher[35] reported the median length of labor among 1170 multiparas induced with oxytocin to be slightly under three hours. Bishop[4] reported the average length of labor among multiparas induced with amniotomy to be 4.1 hours. When the cervix was dilated three centimeters or more and the vertex at minus one or lower, all multiparas in Bishop's series were delivered in four hours and the average duration of labor was 3.2 hours. The length of labor Bishop quoted included the latent period as well. Stone and Gordon[70] report the average length of labor in multiparas induced with oxytocin to be three hours. Keettel[48] noted that rapid labor resulted in no serious complications.

D'Esopo[14] raises the question of rapid labor in the induced patient being more related to the ripeness of the patient's cervix than to induction per se. Both Bishop's results and Thom's impression that precipitate labor is more common in women with decreased resistance of the soft parts would seem to answer D'Esopo in the affirmative.

In the present series there were 265 (49.6%) precipitate labors on the general service and forty-five (26.0%) precipitate labors on the university service. Precipitate labor was most frequent among multiparous women with cervices three centimeters or more dilated at induction, and among gravidas induced with amniotomy. Combining amniotomy with oxytocin or sparteine did not make precipitate labor any more frequent that it was in gravidas induced with amniotomy alone. Combination with amniotomy substantially increased precipitate labor's incidence over that when induction was achieved with oxytocin or sparteine only.

On the general service the length of the previous labor was investigated in 220 multiparas. In thirty-five of these women this information could not be obtained. Among the remaining 185 there were ninety-seven gravidas whose current labor was precipitate. Thirty-eight women whose present labor was precipitate had had precipitate labors in the past. Current labors of more than three hours length occurred in

twenty-three patients whose previous full labor had been precipitate. There were fourteen gravidas whose previous labor had been more than twelve hours long. Eight of these patients (57.1%) did not have precipitate labors at present. Women whose labors had lasted between three and twelve hours previously were evenly divided among those who did and those who did not have precipitate labor at present.

Similar data was obtained on sixty-three university multiparas. Nineteen of these sixty-three gravidas had precipitate labors during the present study. Eight of these patients had had precipitate labors previously, only two of the nineteen had been in labor more than twelve hours during previous confinements. Thirteen women whose labors had previously been rapid had labors lasting more than three hours currently.

It was noted on both services that precipitate labor was more frequent among women with a previous history of short labors. On both services, approximately one third of the patients whose previous labor record was known had had precipitate labors. Over 60% of patients with previous precipitate labor had recurrent precipitate labor on the general service, while 38.1% of similar gravidas on the university service had recurrent precipitous labors. Thus, though a past history of rapid labor seemed to predispose to

short labor, the role of the method of induction in decreasing the length of labor cannot be discounted. Nor, as has previously been noted, can the status of the cervix or the amount of resistance of the soft parts be discounted. All seem to play a part in the increased incidence of precipitous labors among electively induced patients.

Precipitate labor on the general service was associated with an increase in the frequency of postpartum hemorrhage and perineal laceration and a minor increase in the incidence of vaginal laceration. Other complications, such as fetal distress, neonatal depression, and cervical laceration, were decreased in incidence or no more frequent among the gravidas with precipitate labor. On the university service, where complications were more frequent, but precipitate labor half as common, the incidence of all complications was reduced in women with precipitate labor.

1. Five hundred thirty-six patients on the general and one hundred seventy-three patients on the university service underwent elective induction of labor between January 1, 1961 and December 31, 1962.

2. The incidence of elective induction on the general service was 7.1%; on the university service it was 6.6%.

3. Amniotomy, stripping of the membranes, oxytocin, and sparteine sulfate, singly or in combination, were the modes of induction employed.

4. Amniotomy, used 247 times on the general service and eleven times on the university service, was the most efficient method of induction with regard to the length of the latent period following induction, the percent of patients successfully induced, and the length of the labor produced. Combining amniotomy with oxytocin or sparteine decreased the length of the latent period, but did not lead to an increased incidence of precipitate labor.

5. Stripping of the membranes was least effective of the methods used in terms of the length of the latent period, the percent of patients successfully induced, and the length of the labor produced.

6. Gravidas with cervices three centimeters or more dilated responded to the elective induction of labor with shorter labors after shorter latent periods than did women whose cervices were not so widely dilated at induction.

7. There were forty-four women on the general service (8.2%) and fifty patients on the university service (28.9%) who failed to respond to the initial attempt at induction.

8. There were four cases of uterine spasm, all associated with the use of oxytocin or sparteine for induction or stimulation of labor.

9. The incidence of puerperal morbidity, postpartum hemorrhage, and cervical laceration was increased in the induced population on both services.

10. Puerperal morbidity was not related to the length of the latent period on the general service, but did appear to be related to the length of the latent period following digital stripping of the membranes on the university service.

11. Postpartum hemorrhage was most frequent in patients who had been induced or stimulated with oxytocin and in patients whose labors were precipitate.

12. Cervical laceration, though increased in incidence among women who had received oxytocin, appeared to be more directly related to difficult forceps deliveries following prolonged second stage labor.

13. Precipitate labor was the most common complication in this series. The only deleterious effects associated with this were an increase in the incidence of postpartum hemorrhage and the incidence of perineal and vaginal laceration.

14. There was one breech presentation and one set of twins which were not recognized at induction. A total of twelve breech presentations, excluding twins "B", and nine sets of twins were delivered.

15. There was one prolapsed cord, an incidence of 0.14%. This occurred in a breech presentation. It was unrelated to the induction of labor.

16. The incidence of premature births was considerably reduced from the usual incidence in this hospital.

17. Signs of fetal distress were more common in the present series than in other reported series. They were associated primarily with the use of oxytocin.

18. There were seven cases of fetal bradycardia and meconium passage on both services. Three of these infants were delivered by cesarean section.

19. Neonatal depression was not associated with precipitate labor. Neonatal depression occurred most often following labors in which oxytocin had been used for induction or stimulation.

20. Complications of labor, as well as longer labor and an increase in the incidence of failed inductions, were more frequent among nulliparous patients. There seems to be little advantage to the elective induction of nulliparas.

21. There were no maternal deaths, no uterine ruptures, and no fetal deaths related to the elective induction of labor.

The elective induction of labor may be accomplished with a variety of techniques. The most efficient of these is the combination of oxytocin and amniotomy. Stripping of the membranes is both ineffective and hazardous in terms of puerperal morbidity and ought not to be done unless strictly indicated. Best results are obtained by inducing multiparous women with single pregnancies who are at or near term and whose cervices are three centimeters dilated.

None of the dire consequences of maternal or fetal mortality, uterine rupture, or prolapse of the umbilical cord which could be attributed to the induction procedure were encountered in this series. There was an increase in the incidence of puerperal morbidity, postpartum hemorrhage and signs of fetal distress, though a large proportion of the fetal distress noted was probably not significant. These complications did seem to be the result of elective induction. They, as well as the risk of inducing a premature infant, must be balanced against the advantage of a short, well attended labor in a patient psychologically prepared for parturition and not apt to aspirate during anesthesia.

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